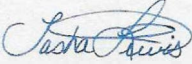


**FINAL 10-ACRE POND REMOVAL ACTION WORK PLAN  
KERR-MCGEE CHEMICAL CORP. - SODA SPRINGS PLANT SUPERFUND SITE  
SODA SPRINGS, CARIBOU COUNTY, IDAHO**

**APPROVAL SIGNATURE PAGE**


**Revision Date:** 5/7/2018

**Approvals:**

  
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Portfolio Manager and Soda Springs Program  
Manager  
Greenfield Environmental Multistate Trust  
LLC, Trustee of the Multistate Environmental  
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By: Greenfield Environmental Trust Group, Inc  
Member

5/11/2018

Date

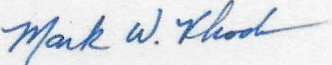
  
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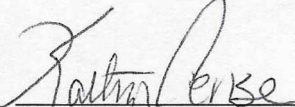
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Greenfield Environmental Multistate Trust LLC  
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May 11, 2018

By Email—[Cerise.Kathryn@epa.gov](mailto:Cerise.Kathryn@epa.gov)

Kathryn Cerise  
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**Subject: Final 10-Acre Pond Removal Action Work Plan  
Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site, Soda Springs, Idaho**

Dear Ms. Cerise:

Pursuant to Section 3.2.6 of the Tronox Multistate Environmental Response Trust Agreement, Greenfield Environmental Multistate Trust, LLC, Trustee of the Multistate Environmental Response Trust (the Multistate Trust), hereby “seeks the prior approval of the Lead Agency . . . to perform Environmental Actions and any work plans to be undertaken by the Multistate Trust under the oversight of the Lead Agency . . . .” Accordingly, the Multistate Trust hereby submits the Final 10-Acre Pond Removal Action Work Plan (RAWP) for the Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site, Soda Springs, Idaho (Site). The RAWP has been updated in accordance with United States Environmental Protection Agency (EPA) and the Idaho Department of Environmental Quality (IDEQ) comments on the Draft RAWP<sup>1</sup>, and EPA/IDEQ-approved responses to comments<sup>2</sup>.

If you have questions or required additional information, please do not hesitate to contact me at (602) 312-6993 or [tl@g-etg.com](mailto:tl@g-etg.com).

Sincerely,

Greenfield Environmental Multistate Trust LLC  
Trustee of the Multistate Environmental Response Trust  
By: Greenfield Environmental Trust Group, Inc., Member

Tasha Lewis  
Portfolio Manager and Soda Springs Program Manager

---

<sup>1</sup> Preliminary comments on the Draft RAWP were provided by EPA and IDEQ to the Multistate Trust on April 17 and 18, 2018, respectively. Additional comments were provided by EPA to the Multistate Trust on April 26, 2018, and a teleconference was conducted May 4, 2018 to discuss final resolution of comments on the RAWP.

<sup>2</sup> Responses to EPA comments were discussed in teleconferences among EPA, IDEQ, and the Multistate Trust on April 18 and April 26, 2018. The Multistate Trust provided written responses to EPA and IDEQ comments on April 24, May 1, and May 4, 2018. Responses to comments were approved by IDEQ on April 25, 2018 and by EPA on May 4, 2018.

Kathryn Cerise

May 11, 2018

Page 2 of 2

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Enclosure

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**10-ACRE POND REMOVAL ACTION WORK PLAN**

**KERR-MCGEE CHEMICAL CORP. – SODA SPRINGS PLANT**

**SUPERFUND SITE**

**SODA SPRINGS, CARIBOU COUNTY, IDAHO**

Prepared for:



**Greenfield Environmental Multistate Trust, LLC**  
**Trustee of the Multistate Environmental Response Trust**

Prepared by:

**Hydrometrics, Inc.**  
3020 Bozeman Avenue  
Helena, MT 59601

May 2018

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**FINAL 10-ACRE POND REMOVAL ACTION WORK PLAN  
KERR-MCGEE CHEMICAL CORP. - SODA SPRINGS PLANT SUPERFUND SITE  
SODA SPRINGS, CARIBOU COUNTY, IDAHO**

**APPROVAL SIGNATURE PAGE**

**Revision Date:** 5/7/2018

**Approvals:**

  
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Tasha Lewis  
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5/11/2018  
Portfolio Manager and Soda Springs Program  
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By: Greenfield Environmental Trust Group, Inc  
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APPENDIX F	HEALTH AND SAFETY PLAN
APPENDIX G	CONFIRMATION SAMPLING AND ANALYSIS PLAN

## LIST OF ACRONYMS

Anadarko	Anadarko Petroleum Corporation
AMSL	Above Mean Sea Level
ARARs	Applicable or Relevant and Appropriate Requirements
bgs	Below Ground Surface
BMPs	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
COCs	Contaminants of Concern
CQA/QCP	Construction Quality Assurance/Quality Control Plan
CSAP	Confirmation Sampling and Analysis Plan
DCP	Dust Control Plan
EM	Electromagnetic
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
F	Fahrenheit
FML	Flexible Membrane Liner
FS	Feasibility Study
GCL	Geosynthetic Clay Liner
gpm	Gallons per Minute
gpm/ft	Gallons per Minute per Foot
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
HELP3	Hydrologic Evaluation of Landfill Performance Version 3
IC	Institutional Controls
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
IHMB	Idaho Hazardous Materials Bureau
KMCC	Kerr-McGee Chemical Corporation
LCRS	Leachate Collection and Removal System
LEL	Lower Explosive Limit
LiDAR	Light Detection and Ranging
MCLs	Maximum Contaminant Level(s)
mg/kg	Milligrams per Kilogram
MSWLF	Municipal Solid Waste Landfill
Multistate Trust	Greenfield Environmental Multistate Trust, LLC, Trustee of the Multistate Environmental Response Trust
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List

O&M	Operation and Maintenance
PGA	Peak Ground Acceleration
PSLs	Project Screening Levels
QA/QC	Quality Assurance/Quality Control
RAOs	Remedial Action Objectives
RAWP	Remedial Action Work Plan
RBPS	Risk-Based Groundwater Performance Standards
RCRA	Resource Conservation and Recovery Act
RFI	Request for Information
RFC	Request for Change
RI	Remedial Investigation
ROD	Record of Decision
RSLs	Regional Screening Level(s)
S-X Pond	Solvent Extraction Pond
SI	Site Investigation
Site	Kerr-McGee Chemical Corp. Soda Springs Plant Superfund Site
SRI	Supplemental Remedial Investigation
SSL	Soil Screening Level
SWPPP	Storm Water Pollution Prevention Plan
TBP	Tributyl Phosphate
TCAM	Time-Critical Action Memorandum
TCRA	Time-Critical Removal Action
TPH	Total Petroleum Hydrocarbons
Tronox	Tronox Limited
µg/L	Micrograms per Liter

# **10-ACRE POND REMOVAL ACTION WORK PLAN**

## **KERR-MCGEE CHEMICAL CORP. – SODA SPRINGS PLANT**

### **SUPERFUND SITE**

### **SODA SPRINGS, CARIBOU COUNTY, IDAHO**

## **1.0 INTRODUCTION**

### **1.1 REMOVAL ACTION WORK PLAN PURPOSE AND SCOPE**

This Removal Action Work Plan (RAWP) specifies the methods and procedures to be used for the Time-Critical Removal Action (TCRA) of the 10-Acre Pond at the Kerr-McGee Chemical Corporation (KMCC) – Soda Springs Plant Superfund Site located in Soda Springs, Caribou County, Idaho (Site). This RAWP was prepared on behalf of the Greenfield Environmental Multistate Trust, LLC, Trustee of the Multistate Environmental Response Trust (Multistate Trust), in support of ongoing environmental investigation at the Site. This RAWP supports the Environmental Actions performed by the Multistate Trust as approved by and under the oversight of the U.S. Environmental Protection Agency (EPA), as Lead Agency for the Site, in consultation with the Idaho Department of Environmental Quality (IDEQ), as the Non-Lead Agency for the Site. The Multistate Trust's objectives are to ensure that the Site conditions are understood and appropriate actions are taken to protect human health and the environment. The TCRA will be performed by the Multistate Trust, and its contractors, in accordance with Section 104 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as presented in the Action Memorandum for a Time-Critical Removal Action for the 10-Acre Pond, approved by EPA on January 22, 2018.



## **1.2 REMOVAL ACTION WORK PLAN ORGANIZATION**

This RAWP describes the work necessary to complete the removal action and is organized as follows:

- Site Background and Setting (2.0);
- Project Organization, Responsibilities, and Coordination (3.0);
- Remedial Design and Removal Action Tasks (4.0);
- Attainment of ARARs and Substantive Permit (5.0);
- Additional Plan Requirements (6.0); and
- Schedule (7.0).

## **2.0 SITE BACKGROUND AND SETTING**

### **2.1 SITE DESCRIPTION**

The Site is located approximately 1.5 miles north of the City of Soda Springs in Caribou County, Idaho and consists of about 547 acres of land on the east side of State Route 34. It is bordered by agricultural land to the north, east, and south and the Monsanto Corporation (Monsanto) phosphate processing plant (Monsanto facility) across State Route 34 to the west. Except for the Monsanto facility, the area within a mile of the Site is generally rural.

The municipal water supply for the City of Soda Springs comes from six springs located near the Site, including: Formation Spring, located approximately 1.5 miles northeast of the 10-Acre Pond; and five springs in the Kelly Park area, located approximately one mile south of the 10-Acre Pond.

Site elevation ranges from 5,960 to 6,040 feet above mean sea level (amsl) and has average high temperatures of 55 degrees Fahrenheit (F) and average low temperatures of 29 degrees F. Average annual rainfall is 15.9 inches, with most precipitation occurring between March and June. The prevailing wind direction is predominantly from the southeast based on windrose data from the Allen H. Tigert Airport.

#### **2.1.1 10-Acre Pond Description**

KMCC constructed the 10-Acre Pond in 1997 to contain liquids and solids from vanadium processing and to contain vanadium production wastes from closure of former process ponds at the Site. The bottom of the 10-Acre pond is reportedly constructed with a multiple layer geosynthetic liner system, consisting of (from bottom to top): a 60-mil high density polyethylene (HDPE) liner; a geocomposite drainage net; and a second 60-mil HDPE liner. This liner system is underlain by a thin soil cushion layer directly on bedrock. The 10-Acre Pond currently contains approximately 1.1 million gallons of water, predominantly from precipitation, and approximately 22,500 cubic yards of evaporite salts, sediment, and production waste solids from the closure of former process ponds. The volume of liquid in the pond fluctuates with precipitation and evaporation. Inspections of the liner and pond

depth measurements are collected monthly. Based on visual inspections of the top of the liner performed by the Multistate Trust's Third-Party Contractor<sup>1</sup> on October 6 and November 17, 2017, there are cracks and tears in the liner, which suggest a high potential for liner failure.

It is important to note that the existing liner may be reaching its functional life expectancy. The functional life of the geosynthetic materials available in 1997 is generally considered to be approximately 20-30 years when used as a pond liner. This life span is typically due to UV degradation (exposure to sunlight) and the maintenance activities associated with a pond, which have the potential to damage the liner, as opposed to a solid waste landfill application where the liner is not disturbed once the first lifts of waste are placed.

Historic and current water and sediment samples collected from the 10-Acre Pond have some of the highest concentrations of molybdenum and vanadium (both Site-related contaminants of concern [COCs<sup>2</sup>], found at the Site) that have been observed in samples collected at the Site. The most recent<sup>3</sup> concentrations of molybdenum in the 10-Acre Pond surface water range from 175,000 to 253,000 micrograms per liter (µg/L) and are higher than the highest concentration of molybdenum detected in the historical liquid discharges sent to the former solvent extraction (S-X) Pond (detected at a concentration of 165,000<sup>4</sup> µg/L in 1992), and higher than the highest concentration of molybdenum detected in groundwater monitoring well KM-8, which is located southeast of the former S-X Pond (detected at a concentration of 165,000 µg/L in 1994).

Appendix C presents the COC concentrations for the 10-Acre Pond sediment and pond water.

---

<sup>1</sup> 10-Acre Pond inspections performed by Thomas Brown, P.E., Pioneer Technical Services, Inc (Pioneer) on October 6, 2017 and Joel Gerhart, P.E., Pioneer and Mark Rhodes, P.E., Hydrometrics Inc.

<sup>2</sup> The ROD identified six chemicals of concern (COCs)—arsenic, manganese, molybdenum, tri-butyl phosphate (TBP), total petroleum hydrocarbons (TPH) and vanadium.

<sup>3</sup> Historical results from the 10-Acre Pond have been as high as 1,200,000 µg/L as reported during the September 22, 2010 10-Acre Pond sampling

<sup>4</sup> This represents the highest concentration of molybdenum detected in groundwater and was collected on 10/26/1994. This result was reported in Appendix B, Table B-3-7 of the Kerr-McGee Chemical Corporation Final Remedial Investigation Report, Soda Springs, Idaho Facility prepared by Dames & Moore in April 25, 1995 (1995 RI report).

## 2.2 SITE HISTORY AND BACKGROUND

From 1963 to 1999, KMCC operated a vanadium production facility at the Site. KMCC stored process water and waste from the production process in several large, unlined ponds. Significant uncontrolled releases of contaminated process water to groundwater from the unlined ponds occurred in both 1981 and in 1989, and led to EPA's decision to add the Site to the National Priorities List (NPL) on October 4, 1989.

KMCC completed the Remedial Investigation (RI) and Feasibility Study (FS) in April 1995. Based on the RI/FS, on September 28, 1995, EPA issued a Record of Decision (ROD) for the Site, which included:

- Elimination of uncontrolled liquid discharges from the Site by replacing unlined ponds with lined ponds;
- Excavation and reuse/recycling of buried calcine tailings (by using calcine to manufacture fertilizer on Site);
- Excavation and disposal of S-X Pond and Scrubber Pond solids into lined ponds on-Site;
- Placement of solids from the ponds in an on-Site landfill<sup>5</sup>;
- In-place capping of windblown calcine and roaster reject material;
- Semi-annual groundwater monitoring to evaluate the effectiveness of source control measures in achieving risk-based groundwater performance standards (RBPS); and
- Inauguration of Institutional Controls (ICs) for off-Site areas to prevent exposure to groundwater for as long as the groundwater exceeds the risk-based concentrations.

Between 1996 and 1997, as part of the remedial action, KMCC constructed three (3) lined ponds, including the East and West 5-Acre Ponds, and the 10-Acre Pond.

In 1997, KMCC constructed the fertilizer plant to reuse calcine tailings from the vanadium plant; however, the operation was not viable. As a result, EPA entered a ROD amendment in

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<sup>5</sup> This landfill has also been referred to as the "RCRA Landfill" in the various Site documents. There is no RCRA permit for the Site; however, the term "RCRA Landfill" has historically been used because this waste repository was reportedly designed and constructed to meet RCRA Subtitle D design standards.

2000 that changed the remedy to in-place capping of the calcine solids combined with ICs to restrict land use and with continued groundwater monitoring.

In 2004, water and sediments in the East and West 5-Acre Ponds were placed in the 10-Acre Pond and then closed, leaving the 10-Acre Pond as the only pond on-Site.

In 2005, KMCC created Tronox Limited (Tronox) by transferring the Site and hundreds of other contaminated sites into this corporate “shell” without the funds required for cleanup of the sites. KMCC then sold its most valuable oil and gas assets to Anadarko Petroleum Corporation (Anadarko). In 2009, unable to pay for cleanup of the KMCC sites, Tronox filed for bankruptcy. In 2011, the U.S. Bankruptcy Court approved the Settlement Agreement with the U.S. government, 24 state governments, Tronox, and others that established several trusts, including the Multistate Trust with very limited funds to address only the most pressing environmental actions. The U.S. took over a lawsuit against Anadarko for fraudulent conveyance, which led to a court approved Anadarko Litigation Settlement on January 21, 2015. Funds from the Anadarko Litigation Settlement were distributed in 2015 and 2016. Since 2014 and with the receipt of the funds from the Anadarko Litigation Settlement, the Multistate Trust under oversight of EPA, as Lead Agency for the Site, in consultation with the IDEQ, as the Non-Lead Agency for the Site has undertaken several environmental actions, including evaluation of the 10-Acre Pond TCRA.

Beneficiaries of the Multistate Trust for the Site are the United States, represented by EPA, and the State of Idaho, represented by IDEQ.

## **2.3 HISTORICAL INVESTIGATIONS AND PREVIOUS REMEDIAL ACTIONS**

### **2.3.1 Preliminary Assessment and Site Investigation**

In May of 1985, the State of Idaho Hazardous Materials Bureau (IHMB) completed a preliminary Site assessment followed by a Site Investigation (SI). The IHMB Site Assessment concluded that: (1) on-Site waste ponds contained variable concentrations of arsenic, cadmium, chromium, lead and vanadium; (2) three organic compounds were present in the Scrubber Pond; (3) groundwater sample results indicated a release from the Site to

shallow ground water; (4) there was evidence of groundwater contamination near the Site, structural features that may affect potential contaminant migration at the Site, and possible contaminant migration at the 60-meter (200-foot) depth (based on two distinct anomalies observed during an electromagnetic (EM) survey; and (5) no domestic or municipal water supply sources appeared to be impacted by Site contaminants. The IHMB SI results concluded that: (1) groundwater was the most likely pathway for contaminant migration; (2) surface water was not considered to be a likely exposure pathway; (3) there was a potential for the exposure to waste pond solids by trespassers or on-Site workers; and (4) potential receptors at the highest risk were considered to be users of nearby irrigation and industrial wells. EPA listed the Site on the NPL on October 4, 1989. EPA issued an Administrative Order on Consent for the RI/FS on September 20, 1990, with an effective date of October 4, 1990.

### **2.3.2 1995 Remedial Investigation (RI)**

Between 1991 and 1994, as part of the RI, under EPA oversight, KMCC collected and analyzed air, soil, wastewater, pond solids and sediment, vadose zone soils, and groundwater samples at the Site. RI sampling locations were outside of the main vanadium plant operation area, which was operational at that time.

The 1995 RI demonstrated that the primary media of concern was groundwater and the primary exposure pathway was ingestion of groundwater. As a result, the remedial action objectives (RAOs) for the Site were designed to prevent ingestion of groundwater with concentrations of vanadium, molybdenum, manganese, tributylphosphate (TBP), and total petroleum hydrocarbons (TPH) in excess of RBPS concentrations and arsenic in excess of the maximum contaminant level (MCL) concentrations. The RBPSs and MCL for arsenic are the established site-specific project-screening levels (PSLs) for COCs at the Site.

A secondary concern identified during the RI was material in the roaster reject area. The RAO associated with this material was to prevent ingestion or direct contact with material with vanadium concentrations above 14,000 milligrams per kilogram (mg/kg).

The major RI conclusions included:

- Air was not a major pathway for exposure;
- Soil contamination was confined to areas near the calcine tailings;
- Gamma radiation readings at the Site were consistent with background levels, except at the iron phosphate ore storage areas (twice [2x] background) and in paved areas, which have crushed slag for road base material. The elevated readings were in the general vicinity of the main vanadium plant area, along the perimeter road west of the former S-X Pond, and at one location along the perimeter road northeast of the East Calcine Repository;
- Metals leached from solid sources contribute to metals concentrations in groundwater, although faults may alter horizontal and vertical hydraulic conductivity;
- Pond leakage from the Scrubber Pond, S-X Pond, and calcine tailings represents the most significant source of COCs in groundwater;
- Advection and preferential flow are the primary chemical transport mechanisms for groundwater;
- Municipal drinking water had not been contaminated by the Site operations, however, off-Site groundwater west and southwest of the Site was impacted by Site COCs and groundwater to surface water impacts were observed in Finch Spring and Big Spring;
- On-Site exposure risks were not significantly higher than background, although the risk could be higher if contaminated solid sources are ingested or if off-Site contaminated groundwater is consumed; and
- Ecological risks were estimated to be minimal, but follow-up investigations were ongoing.

### **2.3.3 1995 ROD**

Section 2.2 identified the remedy components listed in the 1995 ROD. The following remedial actions were taken as part of the implementation of the 1995 ROD and include:

- Routine remedy feature operation and maintenance (beginning in 1996);

- Reclamation of the S-X Pond after the solids were moved to an on-Site, double-lined and capped landfill (Landfill) and the liquids were moved to two lined ponds (East and West 5-Acre Ponds) (1996);
- Construction of the additional double-lined, 10-Acre Pond (1997); and
- Installation of a baghouse system to eliminate the wet-scrubber and process water discharge, closure of the Scrubber Pond (after moving the solids to the on-Site Landfill, containing S-X Pond solids and moving liquids to two lined ponds (East and West 5-Acre Ponds) (1997).

#### **2.3.4 2000 ROD Amendment and Post-ROD Amendment Remedial Actions**

In 2000, the EPA issued a ROD Amendment to address the reuse/recycling of calcine tailings and roaster rejects component of the selected remedy. EPA concluded that the fertilizer plant, constructed at the Site as part of the reuse/recycling remedy, could not meet the ROD-specified cleanup timeframe and required KMCC to implement an alternative remedy for the calcine tailings and roaster rejects.

Based on the previous evaluations in the 1995 ROD, the amendment documented a change in the remedy for the calcine tailings from reuse/recycling to in-place capping (also referred as the East Calcine Repository or East Calcine Area) in combination with ICs restricting land use and continued groundwater monitoring.

After the 2000 ROD Amendment, additional remedial actions and significant milestones included:

- Monitoring wells KM-1 and KM-10 ceased to be included in the groundwater and surface water monitoring program (2000);
- A cap was installed at the East Calcine Repository over the windblown calcine, roaster reject, reject fertilizer, and active calcine tailings (2001);
- An infiltration gallery was constructed on the north side of the East Calcine Repository (2002);



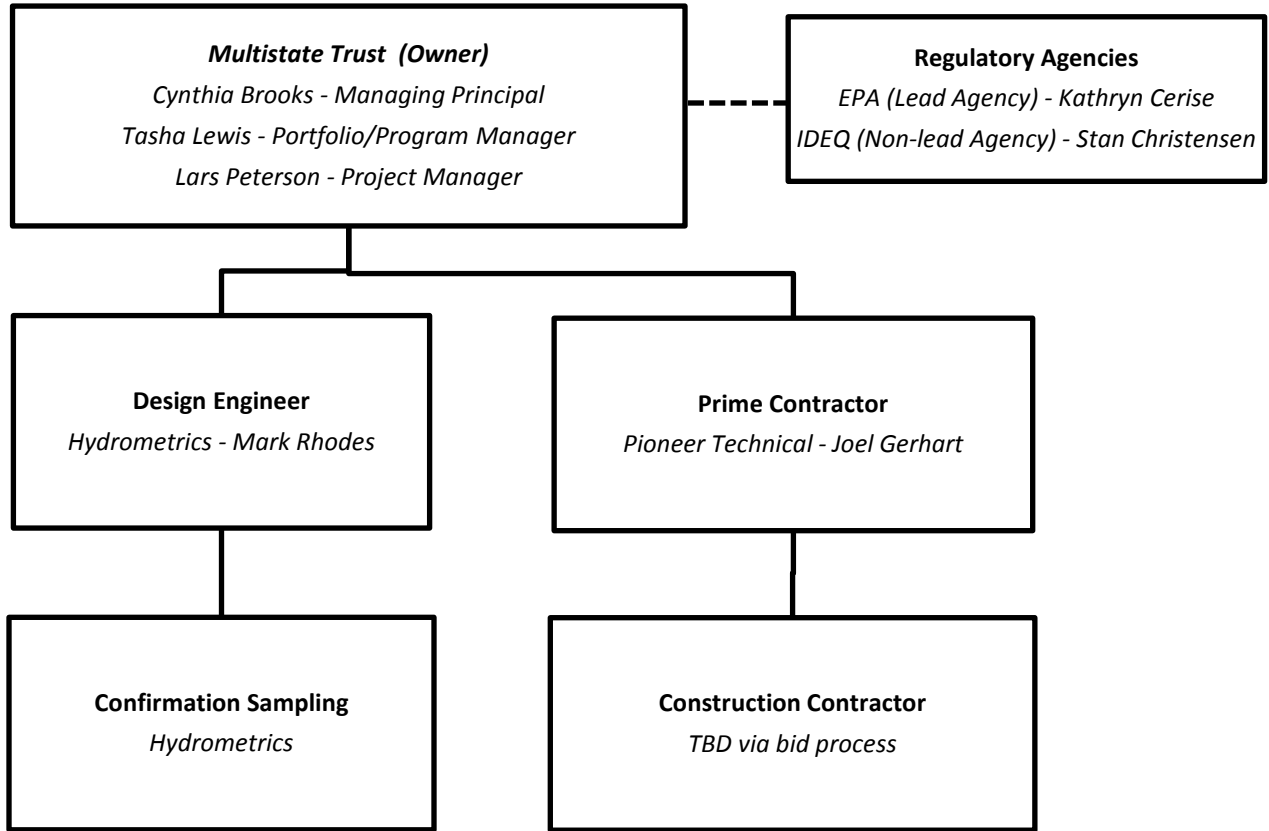
- The vanadium plant at the Site was demolished (2002);
- The fertilizer plant at the Site was demolished (2003);
- Storm water runoff ponds 4 and 5 were reclaimed (2003);
- An infiltration gallery was constructed on the south side of the East Calcine Area (2004);
- The East and West 5-Acre Ponds were reclaimed (2004);
- KMCC purchased the adjacent property (2004);
- KMCC created Tronox (2005);
- Unable to pay for cleanup of the KMCC sites, Tronox filed for bankruptcy (2009);
- The bankruptcy court approved a settlement agreement with the U.S. government, 24 state governments, Tronox, and others that established several trusts, including the Multistate Trust (2011);
- EPA conducted the Third-Five Year Review (2012);
- Funds from the Anadarko Litigation Settlement (approved January 21, 2015) were distributed in 2015 and 2016;
- The Multistate Trust installed thirteen (13) additional on-Site monitoring wells (KM-21 through KM-33) as part of the Phase I Supplemental Remedial Investigation (SRI) to further characterize the extent of COCs in groundwater (2015);
- The Multistate Trust consolidated and disposed off-Site (or recycled) more than 2 million pounds of residual (hazardous and nonhazardous) waste (2015 to 2016);
- Six additional on-Site monitoring wells (KM-34 through KM-37, KM-44, and KM-45) and nine off-Site monitoring wells (KM-38 through KM-43, KM-46, KM-47, and KM-48) were installed during the Phase II SRI to further characterize the extent of COCs in groundwater (2016 to 2017); and
- Site related semi-annual or annual groundwater and surface water monitoring was conducted (1995 to 2017).

### **3.0 PROJECT ORGANIZATION, RESPONSIBILITIES, AND COORDINATION**

The following section describes the project organization and responsibilities. The EPA is the Lead Agency and will review and approve this RAWP and associated design documents. The EPA will work in consultation with IDEQ, the Non-Lead Agency for the Site. The Multistate Trust is the Site Owner (also known as “Owner”) and is responsible for controlling all Site activities and assigning work to the Design Engineer and Prime Contractor. Hydrometrics is the Design Engineer for the project and is responsible for preparing technical documents required for the work and addressing any necessary design changes during construction. Hydrometrics will also provide independent oversight during the work as the Multistate Trust’s representative. Pioneer Technical Services is the Prime Contractor. As Prime Contractor, Pioneer will solicit bids and subcontract with a Construction Contractor to complete the work outlined in this RAWP. As Prime Contractor, Pioneer will assess compliance with the approved RAWP and all permits and also maintain project records. Pioneer will utilize Inspectors to perform on-Site inspection of the work to assure the Construction Contractor meets all expectations and provisions. The Construction Contractor will implement the RAWP to meet the requirements of the 10-Acre Pond TCRA. The Construction Contractor will provide submittals as required in the design documents to the Prime Contractor, with copy to the Design Engineer and the Multistate Trust. The Construction Contractor will have designated Quality Control and Health & Safety representatives. A detailed breakdown of Quality Assurance (QA) and Quality Control (QC) roles is included in the Construction Quality Assurance and Quality Control Plan (Appendix D). Figure 3-1 presents the Organization Chart for the implementation of the 10-Acre Pond TCRA.

Note that while this RAWP references the Demolition Contractor (or “Building Demolition Contractor”), the focus of this document is the 10-Acre Pond TCRA. The Demolition Contractor’s role is minimal with respect to the 10-Acre Pond TCRA. A separate detailed bid solicitation document was prepared for demolition activities to be performed by the Demolition Contractor. A list of major activities and who will be performing these activities for the Site Demolition project and 10-Acre Pond TCRA are provided in Table 3-1.

**FIGURE 3-1. PROJECT ORGANIZATION**



**TABLE 3-1. 10-ACRE POND TCRA AND SITE DEMOLITION ACTIVITIES**

<b>Task</b>	<b>Project</b>
Road construction and improvements	Site Demolition
On-Site repository subgrade excavation	Site Demolition
On-Site repository bottom liner system installation	10-Acre Pond TCRA
Building demolition; haul demolition debris, site soils, calcine, miscellaneous waste to on-Site repository	Site Demolition
10-Acre Pond liquid disposal	10-Acre Pond TCRA
10-Acre Pond solids, geosynthetics, subgrade soils hauled to on-Site repository	10-Acre Pond TCRA
Waste grading and compaction of all materials in on-Site repository	10-Acre Pond TCRA
On-Site repository cover system installation, including cover soil	10-Acre Pond TCRA
10-Acre Pond footprint regrading and cover soil	10-Acre Pond TCRA
General Site-wide regrading and storm water controls	Site Demolition
Site-wide seeding, including on-Site repository	Site Demolition

## **4.0 REMEDIAL DESIGN/REMOVAL ACTION TASKS**

### **4.1 REMOVAL ACTION WORK PLAN RATIONALE**

Work shall include the following:

- Construction of a composite-lined on-Site repository with sufficient volume to contain waste generated from the 10-Acre Pond TCRA and waste generated from Site Demolition and excavation activities;
- Removal and disposal of approximately 1.1 million gallons of residual pond liquids;
- Removal and on-Site disposal of approximately 30,000 cubic yards of pond solids and liners;
- Removal and on-Site disposal of approximately 16,000 cubic yards of impacted soil beneath the pond liner; and
- Backfilling, compacting, regrading, covering, and revegetation of the former pond area.

#### **4.1.1 On-Site Repository Construction**

An on-Site repository will be constructed near the former East and West 5-Acre Ponds because of its proximity to the existing on-Site Landfill. This location was selected because it (1) complies with Subtitle D siting requirements under 40CFR Part 258, Subpart B regarding floodplains, wetlands, fault zones demonstrating Holocene movement, airport locations, and unstable soils, (2) is cost effective in comparison to the cost to transport and dispose of solids from the 10-Acre Pond off-Site (see Tables 3 and 4), (3) is a contiguous footprint with the existing on-Site Landfill, and (4) allows waste materials to be consolidated in one area on-Site to facilitate future redevelopment of the remaining Site property.

The 10-Acre Pond TCRA capacity requirements for the on-Site repository is about 60,000 cubic yards; however, the on-Site repository will be constructed such that approximately 328,020 cubic yards of Site materials can be placed in the on-Site repository to account for expansion and consideration of other non-TCRA activities (for example, cleanup of the fugitive wind-blown calcine and on-Site consolidation of miscellaneous waste areas such as the South Industrial Landfill, etc..). The on-Site repository will be constructed to the

substantive requirements of Subtitle D which include the installation of a 60-mil HDPE primary liner and a geosynthetic clay liner (GCL) secondary liner. A leachate collection and removal system (LCRS) comprised of a geocomposite drainage net and drainage piping are incorporated into the design to maintain less than 12 inches of head from leachate on the liner. A vertical riser sump will extend through the cover to allow any generated leachate to be removed via pumping for disposal off-Site. The repository cover system will consist of a GCL liner, 60-mil HDPE liner, geocomposite drainage net, 18 inches of soil, and 6 inches of growth media (topsoil). The final grade of the cover system will consist of a minimum 2 percent slope on the top and 5H:1V side slopes to promote surface water drainage and to minimize infiltration and erosion. EPA guidance for RCRA/CERCLA final covers states, “Most landfill cover system top decks are designed to have a minimum inclination of 2 to 5%, after accounting for settlement” (Bonaparte et al., 2004). Similarly, Idaho Administrative Procedures Act (IDAPA) 58.01.06, Solid Waste Management Rules require “finished grade shall be at a minimum of two percent (2%) and a maximum of thirty-three percent (33%) slope on the final surface of the completed fill area, after settlement” for non-municipal solid waste landfills. The on-Site repository waste materials are primarily soil and concrete demolition debris that will be compacted during placement, so significant settlement is not anticipated. Minimizing the top slope maximizes waste volume capacity, minimizes the need for additional volumes of limited on-Site cover soil, and minimizes the overall height of the finished repository.

Future leachate collection from the on-Site repository will be placed in on-Site storage tanks for off-Site disposal initially and if applicable may be treated on-Site using a permanent groundwater treatment system installed as part of the final Site remedy<sup>6</sup>.

#### **4.1.2 Removal and Disposal of Residual Pond Liquids**

Efforts will be made to reduce the volume of residual liquids in the 10-Acre Pond requiring off-Site disposal including: (1) utilizing liquids for moisture conditioning of waste in the on-Site repository; (2) spraying the liquids on dry portions of the existing pond liner during hot

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<sup>6</sup> The final remedy has not been selected. Alternatives such as land application of future leachate may be evaluated as part of the focused feasibility study.

dry conditions to promote evaporation and control dust in the on-Site repository; and (3) contractual incentives to minimize off-Site transportation and disposal. The remaining residual liquids not used for moisture conditioning or evaporated will be removed via pumping from a constructed sump and disposed of at a hazardous waste facility for treatment at either the U.S. Ecology Grand View, Idaho facility or the Clean Harbors Aragonite, Utah facility. It is possible the Construction Contractor may identify an alternate facility capable of receiving and disposing of the liquid. Multiple facilities may be used if necessary to meet the project time constraints. Regardless of the facility, the Multistate Trust will seek specific approval from the Lead Agency in advance of transportation and disposal of the residual pond liquids. The timing of the residual liquid removal will target the dry season (July and August) to minimize the quantity of liquid requiring disposal. Sludge and filtered particles remaining once pumping of the liquids is complete, will be dried and stabilized for disposal in the on-Site repository.

#### **4.1.3 Removal and Disposal of Pond Solids**

Pond solids will be consolidated within the lined pond utilizing low-ground-pressure, tracked equipment to push the material into windrows to allow dewatering prior to transport of the solids to the on-Site repository cell. Sludge materials on the existing pond liner will be carefully scraped with HDPE booms attached to blades of excavating equipment to minimize any damage to the existing liner. Sludge will be placed into windrows and allowed to dewater. Once dewatered and free liquids have been removed from the pond solids and sludge, the material will be transported to the on-Site repository to be blended and stabilized with Site soils generated from the building demolition activities. Oversight personnel will visually inspect the pond solids and sludge during loading activities to ensure free water is not draining from the material. The Construction Contractor will not be allowed to load and haul pond solids with free liquid to the on-Site repository.

Analyses have indicated moisture stabilization of the pond solids can be accomplished by gravity draining and utilizing on-Site soils at a mix ratio of 2:1 pond solids to soil. The West Calcine Area soils and other on-Site soils generated from the building demolition activities will be used for blending and moisture stabilization of the pond solids and sludge. The

Demolition Contractor will haul these soils to the on-Site repository in advance of the 10-Acre Pond TCRA activities. Wet pond solids will be placed in lifts with a maximum thickness of 6 inches and mixed with drier soils in the on-Site repository. Once pond solids and liquids have been removed to the extent practical from above the existing pond liner, the liners will be removed and placed in the on-Site repository.

Polymer use was evaluated for removal of pond liquids and stabilization of pond solids; however, based on feedback from numerous vendors, the use of polymers for dewatering and/or mixing of the pond water or sediments is not recommended because of the presence of evaporite salts.

#### **4.1.4 Extent of Excavation**

After removal of the pond solids and existing liners, 1 foot of soil will be removed from the footprint of the 10-Acre Pond and disposed of in the on-Site Repository. Confirmation soil samples will then be collected from the footprint of the 10-Acre Pond. All confirmation soil sampling and analysis will be conducted in accordance with an EPA-approved Confirmation Sampling and Analysis Plan (CSAP) that is included in this RAWP (Appendix G). If contamination levels observed beneath the pond liner indicate additional time-critical conditions exist that require immediate action, these conditions will be promptly raised and additional removal may be necessary. Otherwise, contamination from depths greater than 1 foot, if any, will remain in place and be addressed via ongoing remedial activities for the Site, outside of the scope of the 10-Acre Pond TCRA. Additional subsurface soil investigations are included in the SAP for the SRI that is currently underway. Three soil borings (T3-328, T3-329 and T3-330) have been proposed in this area to specifically assess whether COCs from the 10-Acre Pond are above the industrial RSL and/or protection of groundwater RSLs. Based on CSAP results, soil boring results and groundwater concentrations, it will be determined if additional subsurface investigation in the former footprint of the 10-Acre Pond is necessary to address Site-related risks to human health and the environment. These results will be incorporated into the draft SRI, updated human health and ecological risk assessment, and overall Site-wide remedial approach.

## **4.2 PROJECT PLANNING**

### **4.2.1 Topographic Survey**

A topographic aerial survey of the Site and adjacent area was completed by Aero-Graphics in November 2015 (Aero-Graphics, 2015), including high resolution light detection and ranging (LiDAR) data was collected,. The LiDAR points were used to develop a topographic map of the Site. The survey projection and datum are as follows:

- Projection: Idaho State Plane East Zone projection
- Vertical Datum: NAVD88 (Geoid12A)
- Horizontal Datum: NAD83 (2011)
- Units: US Survey Feet

### **4.2.2 Utility Identification**

Utility location services have been utilized to determine the location of existing utilities to the extent practical. Known utility locations are shown on the Construction Drawings (Appendix A). No utilities have been documented in the 10-Acre Pond or on-Site repository areas. However, the Construction Contractor will be required to complete utility clearance prior to excavation activities.

## **4.3 DESIGN CRITERIA**

The 10-Acre Pond TCRA is designed to remove contaminated liquids and salts/sediments from the 10-Acre Pond area. Pond liquids will be disposed of off-Site, while solids will be consolidated in an on-Site repository. The on-Site repository is the focus of the design criteria and design analysis presented in this RAWP.

The conceptual basis of design of the on-Site repository is presented in the Action Memorandum for a Time-Critical Removal Action for the 10-Acre Pond (EPA, 2018).

Although the on-Site Repository is not a RCRA Subtitle D Facility, the on-Site repository has been designed following the design guidance found in the Resource Conservation and



Recovery Act (RCRA), Subtitle D regulations (40 CFR 258). RCRA Subtitle D regulations are for Municipal Solid Waste Landfills (MSWLF) and include the following:

- Location;
- Composite Liner System;
- Leachate Collection and Removal System;
- Surface Run-on and Runoff Control System;
- Cover System; and
- Post Closure Care.

#### **4.3.1 Location**

Under Subtitle D requirements, a landfill location shall have no:

- Airport runway used by jets within 10,000 feet;
- Other airport runways within 5,000 feet;
- Floodplains;
- Wetlands;
- Faults having displacement in Holocene time within 200 feet; or
- Unstable ground.

The Site is considered a seismic impact zone because the maximum horizontal seismic acceleration exceeds 0.1g for an earthquake magnitude with a 10 percent probability in 250 years. Seismic design considerations and additional siting information are included in Section 4.4 Design Analysis.

#### **4.3.2 Composite Liner System and LCRS**

Subtitle D requires the on-Site repository have a composite bottom liner and a leachate collection system that is designed and constructed to maintain less than a 30-centimeter (12-inch) depth of leachate over the liner. The composite liner must consist of a flexible membrane liner (FML) and 2 feet of compacted soil with a permeability of no more than  $10^{-7}$  centimeters per second. HDPE FMLs must be at least 60-mil thickness.

#### **4.3.3 Run-on and Runoff Control Systems**

A landfill Owner is required to design, construct, and maintain a run-on control system to prevent flow onto the active portion of the landfill during the peak discharge of a 25-year storm. Similarly, a runoff control system is required to collect and control at least the water volume from a 24-hour, 25-year storm. Runoff from the active landfill area must not discharge to waters of the U.S. or cause the discharge of a nonpoint source of pollution to waters of the U.S.

#### **4.3.4 Cover System**

A landfill must have a final cover system designed to minimize infiltration and erosion. The permeability of the cover system must be less than or equal to the bottom liner. The cover system must minimize infiltration by having at least 18 inches of earthen material and minimize erosion by having at least six inches of earthen material capable of supporting native plant growth.

#### **4.3.5 Post Closure Care**

Following closure, a 30-year post-closure care period is required to maintain the integrity of the final cover, maintain and operate the LCRS, monitor groundwater, and maintain and operate the gas monitoring system, if applicable.

#### **4.3.6 Additional Criteria**

Subtitle D requires daily cover of 6 inches of earthen material to be placed over waste at the end of each operating day to control disease vectors, fires, odors, blowing litter, and scavenging. Due to the nature of waste and location of the landfill at the Site, and to conserve available waste storage volume, daily cover will not be used in the on-Site repository.

Groundwater monitoring, sampling, and analysis are addressed in Subtitle D. However, these activities are already ongoing at the Site as part of the long-term groundwater monitoring program, and a new plan will not be implemented for the on-Site repository. The existing long-term monitoring program is sufficient for the on-Site repository.

Records for the on-Site repository will be maintained with other Site records. Records will include design documentation, inspection and monitoring records, and analytical data.

Subtitle D includes explosive gas control requirements for MSWLF units. Landfill Owners must ensure that methane concentrations do not exceed 25 percent of the lower explosive limit (LEL) in facility structures or exceed the LEL at the facility property boundary. The primary source of gas generation within most landfills is typically the decomposition of organic materials (primarily household waste such as paper and lawn waste) and the subsequent release of methane gas. Average municipal (sanitary) landfill refuse contains 55 percent woody materials (paper, grass, leaves, etc.) by weight and 28 percent organic carbon (EPA, 1979). In comparison, on-Site repository waste consists primarily of earthen materials and demolition debris that contain only small quantities of organic materials. Gas generation is anticipated to be minimal, and a gas monitoring plan will not be required. The on-Site repository cover will include vents to prevent the buildup of pressure from any gases generated beneath the impermeable cover system.

Subtitle D requires financial assurance for post-closure care. The on-Site repository construction is part of the larger ongoing remedial action at the Site, so financial assurance specific to the on-Site repository is not necessary at this time.

## **4.4 DESIGN ANALYSIS**

This section discusses design analysis for key components of the on-Site repository construction. Criteria discussed in the previous section are addressed along with other engineering considerations. Supporting data and calculations are included in Appendix C.

### **4.4.1 Location**

The location of the on-Site repository is presented in the Construction Drawings and described further in Section 4.1.1.

#### **4.4.2 Geotechnical Considerations**

Geotechnical details relevant to the on-Site repository design are presented in this section. A map identifying the approximate locations of six boreholes near the East and West 5 Acre Ponds is included in Appendix C, along with the associated boring logs. Boreholes were completed with an AMS PowerProbe to total depths ranging from 11.5 to 20.5 feet below ground surface (bgs). In five of the six boreholes, the total depth was limited by basalt bedrock. Consistency between the ground surface and bedrock varied between holes and with depth within each hole, but the primary field classification was silt (ML). Clayey or sandy components were noted intermittently, with occasional horizons field classified as silty sand (SM). Geotechnical information for the selected location indicates the native soil will provide a suitable base and subgrade for the on-Site repository. The base elevation is designed with at least four feet of separation above the expected basalt bedrock elevation.

Groundwater monitoring has shown that the groundwater table elevation near the East and West 5 Acre Ponds is between 5,880 and 5,993 feet amsl (Tetra Tech, 2017). Wells KM-1, KM-21, KM-25, and KM-32 are located near the on-Site repository location to the south, west, southeast, and northeast, respectively. The low point of the on-Site repository bottom liner is designed at elevation 6,020 feet amsl, providing more than 25 feet of separation above groundwater.

#### **4.4.3 On-Site Repository Size and Configuration**

The on-Site repository is sized to contain waste generated by this removal action and concurrent remedial activities at the Site. Anticipated wastes from the 10-Acre Pond include the pond liquids, pond solids, geosynthetic liner materials, and liner subgrade soils. Other wastes generated from concurrent remedial activities at the Site include demolition debris; surface soils from the demolition area; fugitive calcine deposits, waste currently stored at the South Industrial Landfill (likely contains ACM) and North Industrial Landfill (north of the 10-Acre Pond); dumped material in the escarpment area south of KM-8 and the calcine from the West Calcine Area. The material in the West Calcine Area was characterized in previously completed Supplemental Remedial Investigation (SRI) field activities (see Draft Phase I and Phase II SRI Report, Tetra Tech, Inc., 2017 for results). Based on the laboratory

analytical results and the design of the on-Site repository, no environmental impacts are expected from incorporating calcine from the West Calcine Area as borrow material. Consolidation of material from other areas of the Site are (1) expected to both minimize or eliminate the need to bring in repository construction materials from off-Site (e.g., cushion material), and (2) improve overall Site conditions by including various wastes from their current undesirable locations around the Site into a protective lined repository. A conservative estimate of the maximum anticipated waste volume is 328,020 cubic yards, as shown in Table 4-1. Actual volumes will likely be lower for several of the waste sources.

**TABLE 4-1. ON-SITE REPOSITORY WASTE SOURCES AND APPROXIMATE VOLUMES**

<b>Source</b>	<b>Volume (Cu Yd)</b>
10-Acre Pond Sediment	22,500
12" Under 10-Acre Pond	16,200
IDW Area (by others)	60
Existing Liner at 5-Acre Ponds	150
West Calcine Area (by others)	206,000
9" West Calcine Contingency (by others)	21,600
North Industrial Landfill (by others)	7,000
South Industrial Landfill (by others)	11,000
South Public Dump (by others)	16,750
Building and Site Concrete Demo (by others)	7,000
Site Asphalt (by others)	760
Strip 6" from demo area (by others)	19,000
<b>Total</b>	<b>328,020</b>

The on-Site repository, as shown in the Construction Drawings, has a waste capacity of 328,000 cubic yards. The ultimate elevation will be modified as necessary during construction to match the actual waste volumes produced. As designed, the top surface of the on-Site repository is approximately 5.5 acres. A one-foot increase or decrease in the top elevation changes the waste capacity volume by approximately 9,000 cubic yards.

A perimeter berm surrounds the on-Site repository to provide vehicle access both during and after construction. The berm elevation varies to generally match the existing ground, minimize fill depths where fill is necessary, and promote drainage. The berm is 21.5 feet wide from the top of the base liner slope, which will provide a minimum 10-foot width once cover soil is installed on the cover liner system. The berm will be a permanent feature providing adequate width to facilitate vehicle and equipment traffic for future maintenance and leachate collection activities associated with the on-Site repository.

The bottom liner system is designed with 3:1 slopes, while the cover has 5:1 slopes. The bottom liner slope height varies from one foot at the northwest corner to 17 feet at the southeast corner. The cover liner system has a maximum height of 19 feet, or 21 feet including cover soil.

#### **4.4.4 Waste Materials**

The primary waste materials associated with this removal action include the pond solids, geosynthetic liner materials, and liner subgrade soils. In general, a significant portion of the pond solids will have high moisture content when excavated. The solids will be handled to promote drainage of free liquid prior to delivery to the on-Site repository. Oversight personnel will ensure the Construction Contractor will not load and haul pond solids with free liquid to the on-Site repository. Dry soils obtained from other Site activities will be mixed with the pond solids to produce a final product that is dry enough to be compacted and support equipment. The existing 10-Acre Pond geosynthetics will be cut or shredded to a maximum size of 100 sq. ft prior to hauling, placement, and compaction in the on-Site repository. Pond geosynthetics will be distributed in the on-Site repository to allow gaps of soil between loads to facilitate drainage, and the potential for settling will be minimized by prohibiting successive lifts of geosynthetics. The pond subgrade will be excavated to bedrock or a maximum depth of one foot and also placed in the on-Site repository.

Demolition debris, Site surface soils, waste from various on-Site dumps, and calcine from the West Calcine Area will be transported to the on-Site repository by the Demolition Contractor. This activity will be concurrent with the 10-Acre Pond TCRA. The calcine

material generally has a sandy silt texture and will be spread directly on top of the bottom liner system and immediately below the cover liner system. A three-foot lift of calcine will be placed initially to provide a cushion at the base of the landfill to support construction equipment and protect the liner from demolition debris. A one-foot lift of calcine will be included as a cushion layer below the cover liner system. The calcine cushion will also facilitate gas migration, as discussed later in the design analysis. Laboratory soils testing results for the West Calcine Area are included in Appendix C. Demolition debris will be sized by the Demolition Contractor to minimize void space and assure adequate compaction.

Remaining wastes will be placed and compacted in maximum two-foot lifts utilizing compaction equipment suitable to form a fill that is a firm unyielding mass, free of large voids, and capable of supporting future loading. Proper compaction will reduce the waste volume, ensure geotechnical stability, and prevent differential settlement within the on-Site repository. The Special Provisions include a specified minimum number of 8 passes with compaction equipment and weekly proof rolling to ensure adequate compaction. If soils placed in the on-Site repository are too wet for adequate compaction, a disc or similar implement will be used to work the soil and mix in dry soil. Periodic proof rolling will be used to confirm waste compaction methods. Nuclear density testing will not be used due to material inconsistency. Oversight personnel will continuously monitor moisture content and compaction efforts to address potential settling issues.

#### **4.4.5 Subgrade**

Finish subgrade preparation will be included and will be constructed to the lines and grades shown in the Construction Drawings. Oversized and deleterious material will be removed and the subgrade will be graded smooth to prevent horizontal or vertical GCL bridging of more than one inch. Subgrade will be compacted to 90 percent of standard proctor maximum dry density to form a firm, unyielding surface. In the event of precipitation, the Construction Contractor will be responsible for dewatering the liner subgrade and ensuring proper compaction is maintained prior to deploying any GCL or FML.

#### **4.4.6 Primary Flexible Membrane Liner**

The primary barrier layers for the on-Site repository base and the cover each consist of a HDPE FML. The FML is designed to prevent liquid from entering the closed cell, contain any leachate that is produced from the waste material, and withstand the stresses applied to it from the weight of the waste material and cap, from construction of the cell, and from the settlement of underlying soils.

The primary COCs in the on-Site repository waste are salts, metals, TPH, and TBP (Pioneer et al., 2017). HDPE provides excellent resistance to salts and metals. HDPE may be incompatible with certain hydrocarbons at high concentrations, but is resistant to others such as diesel fuel. TBP is an ester of phosphoric acid with n-butanol. Esters may have an effect on HDPE liners at high concentrations. The potential effect of both hydrocarbons and esters on HDPE is plasticizing, which is reversible once the chemical is removed from the liner. Chemical concentrations in recent analysis of 10-Acre Pond sediments were 52.5 to 2,080 mg/kg for TPH and 1.7 to 370 mg/kg for TBP (Pioneer et al., 2017). It is anticipated that these concentrations will be diluted as waste is handled and placed. Low contaminant concentrations and an effective leachate removal system minimize the risk of these chemicals affecting long-term FML performance. Chemical compatibility data are included in Appendix C.

A minimum thickness of 35 mils is recommended for high installation survivability (Koerner, 2012). The selected FML thickness will be 60-mil, which is consistent with the substantive requirements for Subtitle D. The selected FML will be textured on both sides to provide added friction along the geosynthetic interfaces. FML installation will follow manufacturer guidelines and quality management procedures will be implemented. Horizontal seams are not allowed on the on-Site repository side slopes.

#### **4.4.7 Secondary Geosynthetic Clay Liner**

A GCL will be installed below the FML as a secondary liner for both the bottom liner and cover liner systems. GCL is a proven substitute for compacted clay secondary liners and was the preferred material recommended in the TCAM (EPA, 2018). The liner will consist of a



needle punched reinforced GCL comprised of a uniform layer of granular sodium bentonite encapsulated between a scrim reinforced nonwoven and a virgin staple fiber nonwoven geotextile. The GCL provides a secondary hydraulic barrier as well as a cushion layer to protect the overlying FML. Constructing the base and cover liner systems with the same materials is consistent with Subtitle D requirements that the permeability of the cover system must be less than or equal to the bottom liner.

The GCL will be installed according to accepted practices and manufacturer recommendations. Longitudinal seams must be overlapped a minimum of six inches and sealed with powdered bentonite sealing compound unless the GCL used has Supergroove<sup>®</sup>, which has self-sealing properties and supplemental powdered bentonite is not required. Seams must be oriented parallel to the line of maximum slope. The horizontal end of panel seams must be overlapped a minimum of 12 inches and sealed with powdered bentonite sealing compound. No horizontal seams are allowed on the slopes. During installation, the GCL will be covered by FML or a temporary covering by the end of each day.

#### **4.4.8 Geocomposite**

Geocomposite drainage net will be installed directly on top of each FML. The geocomposite is designed to facilitate drainage and prevent the buildup of liquid on the FML. The geocomposite also provides a cushion to protect the FML during placement of overlying waste or cover soil layers. The on-Site repository liner systems will be sloped at two percent minimum to facilitate drainage. A geocomposite provides a similar function to a gravel drainage system but requires much less depth and therefore increases the waste volume available for a given repository size. Additionally, the calcine cushion layer placed on top of the geocomposite will help facilitate drainage and provide a secondary lateral drainage layer.

The geocomposite consists of eight-ounce nonwoven geotextile layers bonded to each side of a 250-mil geonet drainage layer. The geotextile acts as a filter barrier between the waste and geonet as well as a cushion for the FML. The geocomposite will have a minimum transmissivity of 2.0 gallons per minute per foot (gpm/ft) at 10,000 pounds per square foot of confining pressure. Geocomposite performance was validated using the Hydrologic

Evaluation of Landfill Performance Version 3 (HELP3) model (USACE, 1997). In the HELP3 model, transmissivity of the geocomposite layer was reduced by 50 percent (1.0 gpm/ft) to account for clogging and creep. Model analysis and results are discussed in the LCRS and Cover Soil analysis sections and presented in Appendix C.

#### **4.4.9 Liner System Stability**

Stability of the proposed liner systems on the on-Site repository slopes is assessed in the following paragraphs. Because the bottom liner system has steeper and taller slopes, the stability analysis is focused on the bottom liner system. Sliding analysis of the cover soil system is included in the Cover Soils analysis section. Several calculations are based on hazardous waste landfill calculations, which provide a conservative design basis for the on-Site repository. Calculations dependent on interface friction were completed using large displacement friction angles, which can be considerably lower than peak friction angles. Calculations with assumptions and results are included in Appendix C.

Stress analysis of the FML includes determination of the FML stress by its own weight prior to filling and stress during filling. Liner strain due to potential settlement of the on-Site repository bottom is also considered. Settlement strain calculations were repeated for the GCL. In all cases, the proposed design exceeds minimum recommended safety factors.

Stress analysis of the geocomposite included normal and shear stress analysis within the geonet. Leachate time of travel was also calculated by summing the travel time for the longest path along the on-Site repository slope and bottom. The analysis shows a maximum time of travel to the LCRS trench of about 2.3 hours.

The adequacy of the proposed anchor for the bottom liner system was analyzed as well. The proposed anchor consists of two feet of runout and a two-foot deep anchor trench. The trench width is 1.5 feet, and the bottom FML will be installed across the anchor bottom; however, the calculations only consider the runout and anchor trench depth. The minimum friction interface for the liner system is between the FML and the adjacent geosynthetics (GCL below

and geocomposite above). Calculations show the anchor provides a safety factor greater than 2.5.

Seismic displacement of the bottom liner system was considered for a seismic event with a two percent chance of occurring in a 500-year period. Calculations show peak ground acceleration (PGA) of 0.115g results in a factor of safety equal to one. This acceleration is considered the yield acceleration. The design seismic event has a PGA of 0.37. Analysis shows an anticipated permanent displacement of about two inches for the design event, which is acceptable for the bottom liner system.

#### **4.4.10 LCRS**

The bottom liner system geocomposite will direct leachate to the LCRS. The LCRS will consist of a collection trench along the downgradient (southern) toe of the on-Site repository base. The collection trench contains a four-inch corrugated HDPE perforated drain pipe enveloped in drain gravel. A six-ounce non-woven separation geotextile will be installed on top of the drain gravel to prevent fine grained soil from migrating into the drain gravel. The drain gravel will consist of clean 3/4-inch minus aggregate that will promote drainage and protect the drain pipe. Cleanouts were not incorporated in the LCRS drain pipes due to the required additional penetrations through the cover liner system. However, if the drain pipes become blocked over time, the drain gravel bedding will provide an adequate alternate flow path to the LCRS sump. Maximum leachate production is anticipated during and shortly after waste placement and will decrease with time once the cover system is in place.

The corrugated HDPE perforated drain pipe collects leachate routed to the LCRS trench by the geocomposite layer and conveys it to a sump. An 18-inch diameter smooth HDPE sump riser pipe will be installed for monitoring leachate depth and pumping when necessary. The riser pipe bottom will be installed in the LCRS sump, run up the on-Site repository slope, and daylight along the edge of the on-Site repository. The riser pipe will be recessed in a trench and bedded in gravel to ensure it remains in place during waste placement. The configuration will allow a submersible pump to be lowered in and out of the pipe for removal of any accumulated leachate. The perforated drain pipes will penetrate the riser pipe at the sump,

and the riser pipe section within the sump will also be perforated to enhance leachate collection during pumping. A pipe boot will be installed at the cover liner penetration to provide a water tight seal.

A HELP3 model was developed to validate the ability of the bottom liner geocomposite to convey leachate to the LCRS trench. An extreme case was considered with 10 feet of waste draining on top of the bottom liner system. For the case, initial moisture contents of 20 percent and 30 percent were assumed for the three-foot calcine layer and overlying seven-foot waste layer, respectively, which are significantly higher than anticipated moisture content for the bulk waste materials. Additional soil properties are included in the model output in Appendix C. Model results indicate an initial drainage of 7,806 cubic feet in one day, or approximately 40.5 gpm. Based on the leachate trench length, the flow rate through the geocomposite is 0.04 gpm/ft, which is well below the assumed geocomposite transmissivity of 1 gpm/ft.

Model results also indicate the geocomposite is capable of preventing more than 12 inches of leachate from collecting on the liner system, even in this extreme scenario. The LCRS drain pipe can also convey the large flow from the modeled scenario. Each 4-inch pipe is capable of conveying approximately 52 gpm under gravity flow conditions, and the 40 gpm estimated for this scenario would be split approximately evenly between the two pipes. The perforated drain pipe orifice capacity was also calculated, and even with only a few inches of head on the pipe, the orifice capacity of the perforated pipe far exceeds the pipe flow capacity.

Results from a HELP3 model of the completed on-Site repository indicate the geocomposite maintains less than an inch of head on the bottom liner system (excluding the leachate collection trench). Model output is included in Appendix C.

Leachate can temporarily build up within the LCRS trench until it is removed by pumping from the sump. With the drain gravel and cushion layer in place, the system can temporarily store approximately 73,400 gallons of leachate with one foot of head on the low point of the bottom liner. One foot is the maximum allowable head on the bottom liner, excluding the

LCRS trench. The volume calculation is included in Appendix C. Estimated heap drain down from the HELP3 model indicates leachate generation of approximately 4,200 gallons per year. At this leachate generation rate, the LCRS system has the capacity to contain 17 years of drain-down leachate before pumping would be required. A Site O&M Plan update will be prepared to address LCRS inspection and leachate handling after the on-Site repository is completed.

If a large precipitation event occurs before the cover liner system is installed, especially when the waste lift is relatively thin, the leachate storage volume may be exceeded. The Construction Contractor will be required to pump the LCRS sump and use or dispose of leachate by recirculating the leachate to waste within the on-Site repository or if necessary, hauling offsite to a hazardous waste facility for disposal.

#### **4.4.11 Cover Soils**

The on-Site repository cover will be constructed with 18 inches of subsoil and six inches of growth media. Subsoil will consist of suitable material from the on-Site repository excavation or a designated borrow area at the south end of the Site. The maximum particle size will be limited to three inches and will be visually classified as silt or loam. Growth media will consist of suitable material from the south farmed field on the property. The Demolition Contractor will test growth media borrow soils for agricultural properties and add soil amendments as necessary prior to any placement of the material. During stripping and stockpile operations, growth media will be visually inspected for signs of contamination. Suspected contaminated soil will be segregated and disposed of in the on-Site repository. Once the cover soil is placed on the cover liner system, the on-Site repository will be fertilized and seeded by the Demolition Contractor. The Demolition Contractor will be responsible for the successful establishment of vegetation, as defined in the Demolition Contract.

The on-Site repository top is designed with a slope of 2 percent to promote drainage and 5:1 side slopes to resist erosion and minimize maintenance. A sliding analysis was completed for the cover soils on the side slopes under static, seismic, and construction conditions.

Static analysis indicates the slopes have a factor of safety greater than three, and during a design seismic event, the factor of safety remains above one. Both of these calculations were completed with the full two feet of cover, as this will be the long-term cover configuration. Construction loading was also assessed by evaluating the loads with a Cat D8T LGP dozer. For this analysis, a cover thickness of 1.5 feet was assumed. Calculations indicate a thinner cover reduced sliding resistance, and it is anticipated that the highest potential for stability concerns is when subsoil is being placed and graded. The factor of safety with equipment loading is slightly less than three.

#### **4.4.12 Surface Drainage**

Storm water drainage both during and after construction were considered in the on-Site repository design. The perimeter berm is sloped away from the on-Site repository to divert storm water and prevent run-on both during construction and after closure. The berm itself has limited run-on potential. The existing grade drains away from the perimeter berm in most areas. The only area with potential for run-on to the berm is near the northeast corner of the on-Site repository. The design includes details for a run-on diversion ditch to be constructed as needed in that area. Prior to installation of the cover liner system, waste will be graded to ensure storm water that contacts the waste will be contained within the on-Site repository. A Site-wide regrading effort to be performed by the Site Demolition contractor will be determined upon completion of a final Site survey once all structures, soils, and debris have been removed from the Site. The final Site grading plan will prevent ponding of water at or near the on-Site Repository and collect and convey clean storm water to existing drainage ways.

Construction Best Management Practices (BMPs) will be utilized to manage storm water runoff during construction and until vegetation has stabilized in earthwork areas. Erosion and sediment control is discussed later in the RAWP. Approximately 9.5 acres of the cover area drains to the northwest. A 25-year, 24-hour design storm of 2.2 inches is expected to produce a peak runoff flow of 13.6 cubic feet per second (cfs) and a total runoff volume of 1.1 acre-feet. Once vegetation is established, the peak runoff flow from the 25-year, 24-hour design

storm is reduced to 3.2 cfs with a total runoff volume of 0.4 acre-feet. Runoff calculations were completed using Autodesk Hydraflow Hydrographs and are included in Appendix C. Time of concentration was calculated using the TR-55 method within Autodesk Hydraflow Hydrographs. Manning's n for overland flow were conservatively assumed to be 0.011 for bare soil and 0.015 for vegetated ground, so actual peak flows may be lower. Runoff curve numbers were calculated from the HELP model output. Runoff to both the north and south of the on-Site repository will be routed to the adjacent existing low areas. These low areas will be incorporated into the Site-wide regrading effort to be completed by the Demolition Contractor and will be determined upon completion of a final site survey once all structures, soils, and debris have been removed.

The cover liner system geocomposite will drain surface infiltration to the toe drain system. The toe drain system consists of perforated four-inch corrugated HDPE collection pipes located just beyond the anchor trench and surrounding the west, north, and east perimeter of the on-Site repository. The pipes meet at a solid four-inch corrugated HDPE discharge pipe at the natural low point near the northwest corner of the on-Site repository. Discharge from the pipe will be conveyed away from the on-Site repository via a natural drainage swale draining to the west. A collection pipe was not included along the south perimeter due to the small side slope area draining to the south and minimal infiltration expected on the 5:1 slope.

Two scenarios were considered to evaluate subsurface drainage for the cover soil – bare cover soil prior to vegetation establishment and cover soil with a good stand of grass cover. HELP3 models were developed for both scenarios. Each model was run for a 100-year simulation period using climate information for the Soda Springs area. The model considered the two percent sloping top surface, where the majority of infiltration will likely occur. Model output for both cases is included in Appendix C. The cover soil with vegetative cover results in greater infiltration and higher subsurface drainage. For the 100-year simulation period, peak daily subsurface drainage is 7,476 cubic feet, or approximately 38.8 gpm. The four-inch toe drain pipe has a minimum slope of 0.5 percent, resulting in a gravity flow capacity of 52 gpm. Model results indicate the maximum head on the cover liner is less than six inches for the entire simulation period.

#### **4.4.13 Gas Vent System**

Volumes of potentially gas-producing waste materials placed in the on-Site repository will be minimal; nevertheless, a gas vent system has been incorporated as a conservative design element. A series of three-inch perforated corrugated HDPE pipes will be embedded in the calcine cushion layer immediately below the cover liner system. The calcine layer will allow any accumulated gases to reach the perforated pipes. The piping directs the gas to one of six vent pipe risers distributed evenly across the top of the cell. The vent pipe risers consist of 3-inch smooth HDPE pipe, which extend approximately 12 inches above the top of the cap. The risers will be shaped like a “candy cane” and will have screens over the open end of the pipe to prevent precipitation or objects from entering the pipe. Concrete collars will be cast around the vent pipes for additional support.

### **4.5 MOBILIZATION AND SITE PREPARATION**

#### **4.5.1 Erosion & Sediment Control**

Standard erosion control measures will be constructed and/or placed prior to the start of construction activities and modified as appropriate during the 10-Acre Pond TCRA. The Construction Drawings include an Erosion and Sediment Control Plan and standard drawings. The Construction Contractor will be required to prepare and implement a Storm Water Pollution Prevention Plan (SWPPP).

#### **4.5.2 Utility Clearances**

Prior to construction, utility locates will be performed and compared to any existing and/or historic site drawings of underground utility information to identify as many underground utilities as possible. Previously mapped utilities are shown on the Construction Drawings.

#### **4.5.3 Protection of Monitoring Wells**

Caution will be exercised to protect and ensure the integrity all existing monitoring wells. Existing wells are shown in the Construction Drawings.

### **4.6 HEALTH AND SAFETY**

#### **4.6.1 Traffic Control Plan**



A Traffic Control Plan will be prepared by the Construction Contractor to identify haul routes and describe methods for controlling on-Site vehicular traffic. Vehicles and equipment will be restricted to a speed limit of 15 miles per hour.

#### **4.6.2 Dust Control Plan**

A Dust Control Plan (DCP) will be developed by the Construction Contractor to provide adequate resources to control dust and to detail the means and methods that shall be utilized to implement dust control measures during RAWP activities. The dust control measures shall be designed to control the emission of visible fugitive nuisance dust. These controls shall be accomplished through the use of administrative, engineering, and physical controls.

#### **4.6.3 Vehicle and Equipment Decontamination**

The equipment used in the handling and/or transport of 10-Acre Pond materials will be decontaminated prior to the equipment leaving the Site, or moving from a work zone to an area considered clean. Decontamination pads will be established by the Construction Contractor in areas agreed upon with and approved by the Design Engineer and Multistate Trust. The location of the decontamination pads may change as 10-Acre Pond TCRA activities progress. The equipment that has been decontaminated will be inspected upon completion to ensure the adequacy of the process and to document the process to ensure quality control prior to the transport vehicle leaving the Site.

Decontamination will consist of one or a combination of brushing, vacuuming, or washing methods. The goal of the decontamination is to remove potential COC-containing materials from the areas of the equipment that contact the waste. Upon completion of the decontamination activities, any removed dust and debris residue will be hauled to the on-Site repository.

Transport vehicles will be inspected periodically to ensure that truck beds and gates are properly sealed and that debris is not building up. Full decontamination of vehicles that are leaving the Site shall occur periodically.

#### **4.7 SITE REVEGETATION AND RESTORATION**

Once confirmation soil sampling has confirmed the horizontal and vertical excavation extents and a maximum of one foot of contaminated soils have been removed from the 10-Acre Pond footprint, the area will be regraded, backfilled, and compacted to the lines and grades shown on the Construction Drawings to promote positive drainage away from the former 10-Acre Pond footprint and to minimize erosion. Surface runoff will be routed to the existing heavily vegetated natural drainage way running along the eastern boundary of the former 10-Acre Pond. The area will then have six inches of growth media spread across the surface. Final seeding with native grass will be performed by the Demolition Contractor.

#### **4.8 REMOVAL ACTION COMPLETION REPORT**

A Removal Action Completion Report will be submitted once all of the construction and remediation work is complete and meets the project performance standards. The report will include inspection reports, daily construction reports, stamped as-built drawings, supporting documentation to demonstrate that the Construction Quality Assurance/Quality Control Plan (CQA/CQP) was followed, photo-documentation of work, and laboratory reports.

## **5.0 ATTAINMENT OF ARARS AND SUBSTANTIVE PERMIT REQUIREMENTS**

This section describes how remedial activities at the KMCC Soda Springs Plant Superfund Site 10-Acre Pond will comply with the identified Applicable or Relevant and Appropriate Requirements (ARARs). Table 5-1 and Table 5-2 contain the ARARs identified in the Action Memorandum for the 10-Acre Pond TCRA (EPA, 2018).

### **5.1.1 Compliance with ARARs**

The Action Memorandum for the 10-Acre Pond TCRA (EPA, 2018) contains a complete list of the ARARs applicable to actions implemented at the Site. The Site is subject to these ARARs, which are divided into two types: chemical-specific and location-action-specific. The following presents the substantive compliance for the Site with these ARARs. The discussion of ARARs follows the listed order in Tables 5-1 and 5-2. The tables provide the following: 1) citation; 2) description; 3) summary of requirements; 4) evaluation regarding applicable, relevant, or appropriate; and 5) comments and where referenced in this document.

As indicated in EPA *Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Compliance with Other Laws Manual: Interim Final* (EPA, 1988), the technical specifications developed during design must ensure attainment of ARARs.

In accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 40 C.F.R. § 300.415(j), on-Site removal actions conducted under CERCLA are required to attain ARARs to the extent practicable, considering the exigencies of the situation. Off-site removal activities need only comply with all applicable federal and state laws, unless there is an emergency.

Under CERCLA section 121 (e)(1), federal, state or local permits are not required for the portion of any removal or remedial action conducted entirely on-Site as defined in 40 C.F.R. § 300.5. See also 40.C.F.R. §§ 300.400(e)(1) & (2). On-Site is defined as the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action. On-Site response actions must comply,

to the extent practicable, with substantive but not administrative requirements of ARARs. Off-Site activities such as transportation and disposal of wastes are required to comply with all applicable requirements, including the administrative portions.

As provided in CERCLA Section 121(d)(3) and the Off-site Rule at 40 C.F.R. 300.440 et seq., the off-Site transfer of any hazardous substance, pollutant or contaminant generated during the response action will be sent to a treatment, storage or disposal facility that is in compliance with applicable federal and state laws and has been approved by the EPA for acceptance of CERCLA waste.

### **5.1.2 Chemical-Specific ARARs**

This section describes compliance with all the chemical-specific ARARs as outlined in Table 5-1.

#### **5.1.2.1 Water-Quality ARARs**

Design elements to be used will ensure that the 10-Acre Pond TCRA addresses the water quality criteria listed in Table 5-1. These design elements will include excavation of the new on-Site repository and dewatering operations for removal of the 10-Acre Pond. Temporary measures and BMPs will be used to prevent contaminants from leaving the Site. The BMPs will include filter fencing, cover crop in seed mix, hydro-mulch, and straw wattles, as shown in the Construction Drawings. Dewatering operations will include the use of sumps, pumps, and/or vacuum trucks to dewater the 10-Acre Pond prior to removal of the sediments and sludge. Water from dewatering operations will be collected in tanker trucks and used for moisture conditioning of materials placed in the on-Site repository or hauled off-Site to a licensed disposal facility.

### **5.1.3 Action-Specific ARARs**

The following sections discuss compliance with all location and action-specific ARARs as outlined Table 5-2.

#### **5.1.3.1 Migratory Bird Treaty Act**

Activities will be completed in a manner that avoids the taking or killing of protected migratory bird species: individual birds or their nests or eggs.

#### **5.1.3.2 Hazardous Waste**

Although the 10-Acre Pond wastes are not considered hazardous wastes, the wastes are solid wastes as defined in 40 CFR 261.2 and thus are subject to Subtitle D requirements. In Idaho, solid waste requirements, including the management, processing, waste handling, and disposal of non-municipal solid waste, are promulgated in the IDAPA 58.01.06, Solid Waste Management Rules and are potentially applicable. The 10-Acre Pond TCRA will require the removal, transport, and disposal of water from the 10-Acre Pond, and the removal, transport, and potential stockpiling of sludge and impacted native soils for final disposal in the on-Site repository. The Multistate Trust and Design Engineer will approve the Construction Contractor's proposed plan for stockpiling materials. The Construction Contractor will comply with the requirements for waste management.

#### **5.1.3.3 Clean Water Act**

The Prime Contractor's submitted Erosion Control Plan and/or SWPPP will fulfill the ARARs regarding the Clean Water Act National Pollutant Discharge Elimination System (NPDES) permit program for water quality. The SWPPP will demonstrate compliance for water quality and meet the substantive requirements of the NPDES permit. The Prime Contractor will submit this plan to the Multistate Trust and Design Engineer as part of the Environmental Protection Plan (EPP). The Multistate Trust and Design Engineer will approve the plan prior to starting construction.

BMPs and standard erosion control measures will be utilized throughout the RAWP implementation including controlling dust, providing straw bales around storm drain inlets, placing sand-bags at critical perimeter locations, and avoiding off-site tracking of debris from vehicles. Provisions to avoid ponding and maintain excavations free of storm water runoff shall be addressed. Typically, this will involve filling these locations prior to storms.

Inspections of the erosion control measures will be performed prior to, during, and after storms to evaluate the adequacy of these measures and to manage corrections as necessary. The Prime Contractor is responsible for documentation of the inspection and correction activities, as required. Copies of the documentation shall be forwarded to the Multistate Trust and Design Engineer for review and record retention.

#### **5.1.3.4 Air Quality ARARs**

BMPs will be used to minimize dust emissions. Specifically, dust will be controlled primarily through proper watering of potential dust generation areas and applying water and/or magnesium chloride on haul roads. The Construction Contractor will monitor the Site activities to ensure dust is kept to a minimum and verify that no significant quantities of contaminants become airborne and migrate from the Site.

Meteorological conditions, such as temperature and wind, will also be informally evaluated. These conditions will factor into Site operations to minimize dust generation and emissions. Water trucks will be used to suppress dust on temporary haul road and excavation sites when conditions and access warrant. Also, other techniques, such as the controlled loading of trucks and minimizing the agitation of materials during excavation and loading, will be considered and applied where appropriate.

These control measures for particulate matter will keep air quality in compliance with the primary and secondary air quality standards and toxic air pollutant ambient concentrations.

#### **5.1.3.5 Control of Air Pollution in Idaho**

The dust control measures discussed above will control air pollution in Idaho. The Construction Contractor will meet the Technical Specifications (Appendix B), which require dust control during construction.

**TABLE 5-1. FEDERAL AND STATE CHEMICAL SPECIFIC ARARS**

	Statutes, Regulations, Standards, or Requirements	Citations or References	General Description	Site-Specific Comments	Determination
<b>Federal</b>					
1	Safe Drinking Water Act (SDWA) of 1974, National Primary Drinking Water Standards, and Maximum Contaminant Levels for Inorganic Contaminants	42 U.S.C. 300(f) et seq. 40 CFR 141.61 40 CFR 141.62	Establishes maximum contaminant levels (MCLs) as criteria for groundwater and surface water that are or may be used for drinking water. The standards are designed to protect human health from the adverse effects of organic contaminants in the drinking water.	Applicable to groundwater at the Site, with respect to Arsenic. There are no promulgated standards specified under the SWDA which are exceeded for the other COCs. The Site-specific risk based concentrations apply to the remaining COCs.	Applicable.
<b>State</b>					
1	Idaho Water Quality Standards	IDAPA 58.01.02	Surface water quality standards and waste water treatment requirements, including: water quality criteria for aquatic life use designations (.250), designations of surface waters found within Blackfoot Basin (.150), general surface water quality criteria (.200), antidegradation policy (.051), and mixing zone policy (.060).	Water quality standards are potentially applicable for surface waters on-Site or affected by the selected remedy.	Applicable
2	Idaho Ground Water Quality Rule	IDAPA 58.01.11.200	Protects groundwater for beneficial uses including potable water supplies, establishes use classifications, and establishes water quality criteria for ground water.	Applicable to groundwater at the Site.	Applicable
3	Idaho Rules for Public Drinking Water Systems	IDAPA 58.01.08	Regulates quality and safety of public drinking water.	Potentially applicable if any of the Site water is a public drinking water source; otherwise, substantive requirements would likely be relevant and appropriate.	Potentially applicable and/or relevant and appropriate
4	Rules and Standards for Hazardous Waste	IDAPA 58.01.05	Rules and standards for hazardous waste. Identifies characteristic and listed hazardous wastes and provides rules for hazardous waste permits.	Potentially relevant and appropriate if hazardous waste is identified or generated during implementation of the selected remedy.	Potentially relevant and appropriate
5	Rules for the Control of Air Pollution	IDAPA 58.01.01 (including IDAPA 58.01.01.650 and .651)	Rules providing for the control of air pollution in Idaho.	Potentially applicable depending on the selected remedy.	Potentially applicable
6	Idaho Risk Evaluation Manual for Petroleum Releases	IDEQ (2004b) Available online at <a href="https://www.deq.idaho.gov/media/967298-risk_evaluation_manual_2004.pdf">https://www.deq.idaho.gov/media/967298-risk_evaluation_manual_2004.pdf</a>	Provides guidelines and criteria to apply in risk-based decision making for petroleum releases.	Potentially relevant and appropriate if during the remedial action petroleum is released or a petroleum release is identified.	Potentially relevant and appropriate

**TABLE 5-2. FEDERAL AND STATE LOCATION AND ACTION SPECIFIC ARARS**

	Statutes, Regulations, Standards, or Requirements	Citations or References	General Description	Site-Specific Comments	Determination	Location or Action Specific
<b>Federal</b>						
1	Migratory Bird Treaty Act	16 U.S.C. 703 et seq.	Protects all migratory bird species. It shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird, any part, nest, or egg of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof.	The prohibition is relevant and appropriate to areas of the Site where remedial action is selected that may provide habitat to migratory birds.	Potentially applicable and/or relevant and appropriate	Action
2	Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds	Executive Order 13186 of January 10, 2001	Encourages federal agencies to integrate migratory bird conservation principles into plans and actions.	TBC	Potentially applicable and/or relevant and appropriate	Action
3	RCRA: Subtitle D—RCRA Criteria for Classification of Solid Waste Disposal Facilities and Practices	42 U.S.C. 6901 et seq.; 40 CFR 257	Certain criteria are required to be met by solid waste disposal facilities and practices, such as not restricting the base flow of the floodplain, not taking threatened or endangered species, and not causing a discharge to navigable waters.	The substantive requirements are relevant and appropriate to remedial actions that involve the consolidation of on-Site wastes in repositories or beneath protective barriers.	Potentially applicable and/or relevant and appropriate	Action
4	RCRA Subtitle D—Disposal of Nonhazardous Solid Waste	42 U.S.C. 6901 et seq.; 40 CFR Part 258	Provides criteria for cover material, run-on/runoff control systems, access control, and liquid restrictions.	The substantive requirements are relevant and appropriate to remedial actions that involve the consolidation of mine wastes in repositories or beneath protective barriers.	Potentially applicable and/or relevant and appropriate	Action
5	RCRA: Subtitle C—Hazardous Waste Characteristics	40 CFR 261.20	Generators of solid waste must determine whether the waste is hazardous. A solid waste is hazardous if it exhibits the toxicity characteristic (based on extraction procedure Method 1311).	Applicable to characterization of unknown waste that may be encountered during the removal action.	Potentially applicable and/or relevant and appropriate	Action
6	Best Management Practices for Soil Treatment Technologies	OSWER, 1997	Provides technologies for controlling cross-media transfer of contaminants during materials handling activities.	TBC during excavation of contaminated soil.	Potentially applicable and/or relevant and appropriate	Action
7	Clean Air Act	42 U.S.C. 7401 et seq.	Requires minimization of the harmful effects to air quality from excavation, construction, and other removal activities.	The substantive requirements of these regulations are relevant and appropriate to remedial actions that may involve the generation of fugitive dust (e.g., removal, transport, and consolidation of contaminated soil / sediments).	Potentially applicable and/or relevant and appropriate	Action
8	Clean Water Act (402)/ National	33 U.S.C. 1251	Specifies requirements under 40 CFR 122 for point-source	May be applicable if the selected remedy results in	Potentially applicable and/or	Action



**TABLE 5-2. FEDERAL AND STATE LOCATION AND ACTION SPECIFIC ARARS**

	Statutes, Regulations, Standards, or Requirements	Citations or References	General Description	Site-Specific Comments	Determination	Location or Action Specific
	Pollutant Discharge Elimination System	40 CFR 122 and 125	discharge of storm water from construction sites to surface water and provides for Best Management Practices such as erosion control for removal and management of sediment to prevent run-on and runoff.	point source discharges.	relevant and appropriate	
<b>State</b>						
1	Protection of Birds	Idaho Code Ann. § 36-1102	Prohibits the “take” or intentional disturbance or destruction of eggs or nests of any “game, song, rodent killing, insectivorous or other innocent bird.” The prohibition does not apply to English Sparrows or starlings.	Potentially applicable during remedial action.	Potentially applicable	Action
2	Non-point Source Discharges	IDAPA 58.01.02.350	Regulates non-point source discharges, designates approved BMPs and provides additional protection for outstanding resource waters.	May be applicable if the selected remedy results in non-point source discharges.	Potentially applicable	Action
3	Point Source Discharges	IDAPA 58.01.02.400-.401	Provides limits and restrictions including possible limits on temperature and flow rates for point source discharges.	May be applicable if the selected remedy results in point source discharges.	Not applicable	Action
4	Storage of Hazardous and Deleterious Materials	IDAPA 58.01.02.800	Prohibits the storage, disposal or accumulation of hazardous and deleterious materials “adjacent to or in the immediate vicinity of state waters” without adequate measures and controls to insure the materials will not enter state waters.	May be relevant and appropriate if the remedial action results in the storage of hazardous and deleterious materials near state waters.	Not applicable.	Action
5	Well Construction Standard Rules	IDAPA 37.03.09	Regulates well construction and abandonment.	May be applicable if the selected remedy includes additional wells.	Potentially applicable	Action
6	Best Management Practices (BMPs) and Reclamation for Surface Mining Operations	IDAPA 20.03.02.140	Provides BMP and reclamation standards for surface mining operations, including sand and gravel mining.	May be applicable depending on the selected remedy. BMPs may also be relevant and appropriate to remediation activities (i.e. grading, re-contouring, and revegetation).	Potentially applicable and/or relevant and appropriate	Action
7	Idaho Water Quality Standards and Wastewater Treatment Requirements	IDAPA 58.01.02	Requirements for actions involving effluent discharges to surface water.	May be applicable if water treatment is part of the selected remedy.	Not applicable.	Action
8	Solid Waste Management Rules	IDAPA 58.01.06	Provides substantive requirements for operation and closure of solid waste management facilities.	Only material uniquely associated with phosphate mining is being addressed in the remediation so these requirements are not applicable because the Site is not a solid waste management facility. See IDAPA 58.01.06.001.03(b)(iv). Some requirements may be relevant and appropriate with regard to regulated solid waste generated during the remedial action.	Potentially relevant and appropriate	Action
9	Hazardous Waste and Hazardous Waste Management Act of 1983	IDAPA 58.01.05 1993 Session Law, Ch. 291,	Adopts federal RCRA regulations concerning the identification of hazardous waste and standards applicable to generators and	Potentially applicable for management of investigation derived wastes and remediation	Potentially applicable	Action

**TABLE 5-2. FEDERAL AND STATE LOCATION AND ACTION SPECIFIC ARARS**

	<b>Statutes, Regulations, Standards, or Requirements</b>	<b>Citations or References</b>	<b>General Description</b>	<b>Site-Specific Comments</b>	<b>Determination</b>	<b>Location or Action Specific</b>
		Sections 1-8	transporters of hazardous waste as well as standards for owners and operators of hazardous waste treatment, storage and disposal facilities.	wastes.		
10	Idaho Rules for Control of Fugitive Dust	IDAPA 58.01.01.650-651	Provides practices for controlling fugitive dust emissions, including use of water or chemicals, application of dust suppressant, and covering trucks.	May be applicable during remedial action if construction practices generate fugitive dust.	Potentially applicable	Action
11	Idaho Toxic Air Pollutants	IDAPA 58.01.01.585-586	Requirements for maintaining air quality (none currently nor will they be likely associated with any remedial action).	Potentially applicable depending on the selected remedy.	Potentially applicable	Action
12	Preservation of Historical Sites	Idaho Code §§ 67-4111 to -4131 and 67-4601 to -4619	Requirements for protection of public lands and preservation of historical or archaeological sites in consideration of waste disposal.	Requirements may be applicable if historical or archeological sites are present and/or may be disturbed during the remedial action.	Potentially applicable	Location
13	Idaho Classification and Protection of Wildlife Rule	IDAPA 13.01.06.300	Classifies fish and wildlife species; identifies threatened or endangered species; and specifies wildlife species that are protected from taking and possessing.	To be considered during ecological risk assessment.	Applicable	Location
14	Idaho Uniform Environmental Covenants Act	Idaho Code §§55-3001 to -3015	Allows recordation of an environmental covenant, which is a written agreement where the parties bind themselves and their successors in interest to the land, to comply with activity and use limitations.	Any environmental covenant must follow this Act	Applicable	Action
15	IDEQ Area Wide Risk Management Plan	IDEQ (2004a)	Recommends removal action goals and action levels for addressing releases and impacts from historical phosphate mining operations in southeast Idaho.	May be taken into consideration in developing risk-based cleanup levels.	TBC	Action
16	Variances from water quality standards	IDAPA 58.01.02.260	Establishes procedures and requirements for obtaining a water quality variance.	Potentially applicable if Site-specific variances are proposed for a particular location or source.	Not applicable	Action

## **6.0 ADDITIONAL PLAN REQUIREMENTS**

### **6.1 CONSTRUCTION QUALITY ASSURANCE PLAN**

The Construction Quality Assurance/Quality Control Plan (CQA/QCP) provides guidance in attaining and maintaining high quality work throughout the construction of the on-Site repository and leachate collection system. The CQA/QCP will also address responsibilities and authorities, project records, and data management and control. The CQA/QCP is included as Appendix D.

### **6.2 CONSTRUCTION OPERATION AND MAINTENANCE PLAN**

A Construction Operation and Maintenance Plan (O&M) Plan has been developed and is included as Appendix E. The Construction O&M plan includes procedures for project communication, waste hauling, dust control, documentation, record keeping, inspections, daily operating logs, Site maintenance, and other elements as necessary for effective and efficient operations and maintenance of the 10-Acre Pond and on-Site repository during construction. Once the removal action has been completed, the existing O&M Plan for the Site will be updated to include long-term O&M requirements related to the removed 10-Acre Pond area and new on-Site repository. Ongoing O&M activities will be modified as necessary and such activities will continue to be provided to EPA in regular monthly progress reports for the Site.

### **6.3 SITE HEALTH AND SAFETY PLAN**

A Site Health and Safety Plan (HASP) has been developed for the protection and safety of personnel implementing remedial action. The HASP contains community protection requirements, Site emergency procedures, and telephone listing of key individuals. The HASP is included as Appendix F.

### **6.4 CONFIRMATION SAMPLING AND ANALYSIS PLAN**

A Confirmation Sampling and Analysis Plan (CSAP) for soil has been prepared. The CSAP addresses sampling and quality assurance procedures for the soil beneath the 10-Acre Pond liner. The CSAP is included as Appendix G.

## **6.5 COORDINATION**

### **6.5.1 Weekly Progress Meetings**

The Prime Contractor will host Weekly Progress Meetings in which the Contractor(s), project oversight personnel, and Multistate Trust representative(s) will participate. The IDEQ and EPA are invited to participate via phone or in person, and the meeting host will notify the EPA and IDEQ of the time and location of the weekly meeting. Weekly construction meetings will include a review of work conducted the previous week, problems encountered, project progress, and the anticipated schedule for the following two weeks. The status of current Requests for Information (RFIs) and/or Requests for Change (RFCs) will be reviewed in the meeting. The Prime Contractor will be responsible for providing a weekly update and the following two week's schedule. The meeting host will provide a meeting agenda including meeting minutes for the previous week.

### **6.5.2 Periodic Schedule Update Meetings**

Periodic Schedule Update Meetings will be held between the Multistate Trust and the Prime Contractor. The purpose of the meetings will be to review the Prime Contractor's proposed out-of-sequence corrections, determine causes for delay, identify corrective actions, and maintain schedule accuracy. Meetings will occur at least monthly and after the Multistate Trust reviews any project schedule update. This meeting can be held in conjunction with the Weekly Progress Meeting (Section 6.5.1).

### **6.5.3 Problem or Work Deficiency Meetings**

If necessary, a special meeting will be held when and if a problem or deficiency is present or likely to occur. At a minimum, the meeting will include Prime Contractor, Design Engineer, the Multistate Trust, and the Construction Contractor. Other additional personnel will attend at the request of the Multistate Trust. The purpose of the meeting is to resolve the problem as expediently as possible by:

- Defining and discussing the problem or deficiency;
- Reviewing alternative solutions; and
- Implementing an action plan to resolve the problem or deficiency.

Prime Contractor will document the meeting and distribute the meeting minutes to the Multistate Trust, the Design Engineer, and other appropriate parties within three days of the meeting.

## **6.6 PROBLEM IDENTIFICATION AND CORRECTIVE MEASURES**

A *problem* is defined as material or workmanship that does not meet the requirements of the plans or specifications for the project or any obvious defect in material or workmanship. If a problem is identified, the Prime Contractor will inform the Design Engineer, Multistate Trust and the Contractor of the problem, note the following information in the Construction Daily Report, and include pertinent information on the working as-built drawings with as much detail as possible:

- A location and applicable area or volume of the problem;
- Description of the problem with sufficient detail and supporting sketches or photographic information to adequately describe the problem;
- When and by whom the problem was located with reference to applicable inspections or a daily summary report;
- Corrective measure(s) taken by Prime Contractor; and
- Entity and person approving any corrective measure(s).

## **6.7 POST-CONSTRUCTION ACTIVITIES**

### **6.7.1 Punch-List Inspection**

Near the completion of construction activities, the Prime Contractor's Construction Quality Control Manager, Design Engineer and the Multistate Trust will inspect the work and develop a punch list of items that do not conform to the approved Construction Drawings and Technical Specifications. The punch list will be prepared as per the Technical Specifications (Appendix D) and submitted to the Construction Contractor. The list of deficiencies will include the estimated date by which the deficiencies will be corrected. The Prime Contractor's Construction Quality Control Manager, Design Engineer, and the Multistate Trust will complete a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Construction Contractor will notify Contractor that the 10-

Acre Pond area and on-Site repository is ready for the pre-final inspection and Prime Contractor will, in turn, notify the Multistate Trust, Design Engineer, EPA and IDEQ.

### **6.7.2 Pre-Final Inspection**

The pre-final inspection will consist of a walk-through of the entire 10-Acre Pond area and the on-Site repository with the Multistate Trust, Design Engineer, Prime Contractor, and Construction Contractor. EPA and IDEQ will attend at their discretion. Through this inspection, the parties will determine whether the 10-Acre Pond TCRA is complete and consistent with the RAWP and Contract Documents; review compliance with the CQAP; review field changes and change orders; and verify that the data quality objectives have been achieved.

Within seven working days of the pre-final inspection, Contractor will prepare a pre-final construction inspection report. The completion dates for the outstanding items identified in the pre-final construction inspection report will be within 30 days of the inspection unless otherwise agreed upon with the Multistate Trust, EPA and IDEQ.

### **6.7.3 Final Inspection**

The Prime Contractor's Construction Quality Control Manager will provide notice to the Multistate Trust when the final inspection can be scheduled, and submit the notice to the Multistate Trust at least seven calendar days prior to the final acceptance inspection. The notice will include the Prime Contractor's assurance that all specific items previously identified to the Construction Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Contractor will schedule the final inspection.

The Prime Contractor's Construction Quality Control Manager, Design Engineer, Construction Contractor, and the Multistate Trust, will attend the final inspection. EPA and IDEQ will attend at their discretion. The final acceptance inspection will consist of a final walk-through inspection of each discrete element of the 10-Acre Pond TCRA. The pre-final construction inspection report will be used as a checklist, with the final inspection focusing

on items identified during the pre-final inspection. Resolution of all outstanding items will be documented in the Removal Action Completion Report.

#### **6.7.4 Closeout Submittals**

At the 10-Acre Pond TCRA closeout, the Prime Contractor will provide Project Records (including analytical and chemical quality control results in final report format, as-built drawings, records, and correspondence) and a Removal Action Completion Report to the Multistate Trust and Design Engineer in the format specified in the Technical Specifications (Appendix B). Hand marked-up drawings are acceptable for the as-built drawings. The Prime Contractor will submit as-built field data to the Multistate Trust for review and approval a minimum of 30 calendar days after substantial completion. If review of the preliminary as-built drawings reveals errors and/or omissions, the drawings will be returned to the Prime Contractor for correction. The Prime Contractor will make all corrections and return the drawings for back-check to the Multistate Trust and Design Engineer within 10 calendar days of receipt. The record field data will be incorporated into the record drawings by the Design Engineer.

#### **6.7.5 Record Drawings**

The Prime Contractor will prepare record drawings for the Multistate Trust and EPA review. Following incorporation of any comments, the Multistate Trust will provide EPA with a copy of the final approved record drawings for the project in both hard copy and electronic AutoCAD format. The record drawings will also be incorporated into the Removal Action Completion Report.

#### **6.7.6 Contingency Plan**

Contingency measures are necessary for unanticipated releases of Site contaminants and for potential releases of petroleum products from equipment and vehicles used at the Site. Each of these scenarios will be addressed by the Prime Contractor through the preparation of an EPP, consistent with the requirements of Section 01310 of the Technical Specifications (Appendix B).

### **6.7.7 Reporting**

The Multistate Trust will at a minimum, provide construction updates to EPA and IDEQ in the Monthly Progress Reports, along with other routine communications. QA/QC reporting is described in the CQA/QCP.



## **7.0 SCHEDULE**

The Construction Contractor will submit a construction schedule for project progress monitoring after the project award as per Section 01041 of the Technical Specifications (Appendix B). Deviations from the schedule that extend the projected completion by more than one week will be submitted by the Construction Contractor to the Prime Contractor and Design Engineer. Based on recommendations from the Design Engineer, the Multistate Trust will either approve or disapprove the change order. Because a Construction Contractor has not been selected, a schedule is not incorporated at this time. The Design Engineer's schedule has been included in Table 7-1.

TABLE 7-1 - ENGINEERS SCHEDULE

ID	Task Name	Duration	Start	Finish	November 1		January 1		March 1		May 1		July 1		September 1		November 1		January 1		March 1		May 1									
					10/22	11/19	12/17	1/14	2/11	3/11	4/8	5/6	6/3	7/1	7/29	8/26	9/23	10/21	11/18	12/16	1/13	2/10	3/10	4/7	5/5							
1	Multistate Trust: Soda Springs Site-10-Acre Pond	417 days	Mon 10/23/17	Tue 5/28/19																												
2	Prepare 10-Acre Pond Time Critical Action Memorandum (TCAM)	66 days	Mon 10/23/17	Mon 1/22/18																												
3	Prepare and Submit 10-Acre Pond TCAM to EPA	16 days	Mon 10/23/17	Mon 11/13/17																												
4	Submit 10-Acre Pond TCAM to EPA	0 days	Wed 11/15/17	Wed 11/15/17																												
5	EPA/IDEQ Review of 10-Acre Pond TCAM	25 days	Wed 11/15/17	Tue 12/19/17																												
6	Responses to EPA/IDEQ TCAM Comments	3 days	Wed 12/20/17	Fri 12/22/17																												
7	EPA Tech Review Meeting	0 days	Thu 1/4/18	Thu 1/4/18																												
8	EPA Approval of 10-Acre Pond TCAM	21 days	Mon 12/25/17	Mon 1/22/18																												
9	Prepare 10-Acre Pond Removal Action Work Plan (RAWP)	75 days	Tue 1/23/18	Mon 5/7/18																												
10	Prepare & Submit Draft RAWP	30 days	Tue 1/23/18	Mon 3/5/18																												
11	Multistate Trust Review of RAWP	5 days	Tue 3/6/18	Mon 3/12/18																												
12	Revise and Submit RAWP to EPA/IDEQ	5 days	Tue 3/13/18	Mon 3/19/18																												
13	Submit Draft 10-Acre Pond RAWP to EPA	0 days	Mon 3/19/18	Mon 3/19/18																												
14	EPA/IDEQ Review Draft RAWP	25 days	Tue 3/20/18	Mon 4/23/18																												
15	EPA/IDEQ comments on Draft 10-Ac Pond RAWP	0 days	Mon 4/23/18	Mon 4/23/18																												
16	Revise, Finalize and Submit Final RAWP	5 days	Tue 4/24/18	Mon 4/30/18																												
17	EPA/IDEQ approval of Final RAWP	5 days	Tue 5/1/18	Mon 5/7/18																												
18	Final RAWP Approved	0 days	Mon 5/7/18	Mon 5/7/18																												
19	Confirmation Sampling & Analysis Plan (CSAP)	86 days	Mon 1/8/18	Mon 5/7/18																												
20	Prepare Draft CSAP SOW	5 days	Mon 1/8/18	Fri 1/12/18																												
21	Submit Draft CSAP SOW to Multistate Trust	0 days	Fri 1/12/18	Fri 1/12/18																												
22	Multistate Trust Review Draft SOW	5 days	Mon 1/15/18	Fri 1/19/18																												

Project: 10-Acre Pond TCAM Project Date: Mon 3/5/18	Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
	Split		External Tasks		Inactive Summary		Manual Summary		Progress	
	Milestone		External Milestone		Manual Task		Start-only			
	Summary		Inactive Task		Duration-only		Finish-only			

TABLE 7-1 - ENGINEERS SCHEDULE

ID	Task Name	Duration	Start	Finish	November 1		January 1		March 1		May 1		July 1		September 1		November 1		January 1		March 1		May 1					
					10/22	11/19	12/17	1/14	2/11	3/11	4/8	5/6	6/3	7/1	7/29	8/26	9/23	10/21	11/18	12/16	1/13	2/10	3/10	4/7	5/5			
23	Finalize CSAP SOW	2 days	Mon 1/22/18	Tue 1/23/18	<p>The Gantt chart displays the project schedule from January 1 to May 1, 2018. The tasks are plotted as horizontal bars, with dependencies indicated by arrows. Task 34, 'Contractor Procurement', is a summary task spanning from Tuesday, March 20, to Thursday, May 31, 2018. The tasks are as follows:</p> <ul style="list-style-type: none"><li>23: Finalize CSAP SOW (Mon 1/22/18 to Tue 1/23/18)</li><li>24: Multistate Trust Reviews and Signs CSAP SOW (Wed 1/24/18 to Fri 1/26/18)</li><li>25: Prepare &amp; Submit Draft CSAP (Mon 1/29/18 to Mon 3/5/18)</li><li>26: Multistate Trust Review of Draft CSAP (Tue 3/6/18 to Mon 3/12/18)</li><li>27: Revise and Submit Draft CSAP to EPA/IDEQ (Tue 3/13/18 to Mon 3/19/18)</li><li>28: Submit Draft 10-Acre Pond CSAP to EPA (Mon 3/19/18 to Mon 3/19/18)</li><li>29: EPA/IDEQ Review Draft CSAP (Tue 3/20/18 to Mon 4/23/18)</li><li>30: EPA/IDEQ comments on Draft CSAP (Mon 4/23/18 to Mon 4/23/18)</li><li>31: Revise, Finalize and Submit Final CSAP (Tue 4/24/18 to Mon 4/30/18)</li><li>32: EPA/IDEQ approval of Final CSAP (Tue 5/1/18 to Mon 5/7/18)</li><li>33: Final CSAP Approved (Mon 5/7/18 to Mon 5/7/18)</li><li>34: Contractor Procurement (Tue 3/20/18 to Thu 5/31/18)</li><li>35: Prepare and Submit Draft Procurement SOW (Tue 3/20/18 to Mon 4/2/18)</li><li>36: Submit Draft Procurement SOW to Multistate Trust (Mon 4/2/18 to Mon 4/2/18)</li><li>37: Multistate Trust Review of Draft Procurement SOW (Tue 4/3/18 to Mon 4/9/18)</li><li>38: Finalize Procurement SOW (Tue 4/10/18 to Wed 4/11/18)</li><li>39: Multistate Trust Reviews and Signs Procurement SOW (Thu 4/12/18 to Mon 4/16/18)</li><li>40: Signed Procurement SOW (Mon 4/16/18 to Mon 4/16/18)</li><li>41: Shortlist Contactors (Tue 4/24/18 to Mon 4/30/18)</li><li>42: Prequalify Bidders (Tue 5/1/18 to Mon 5/7/18)</li><li>43: Solicit Bids from Contractors (Tue 5/8/18 to Fri 5/25/18)</li><li>44: Site Walk (Tue 5/15/18 to Tue 5/15/18)</li></ul>																							
24	Multistate Trust Reviews and Signs CSAP SOW	3 days	Wed 1/24/18	Fri 1/26/18																								
25	Prepare & Submit Draft CSAP	26 days	Mon 1/29/18	Mon 3/5/18																								
26	Multistate Trust Review of Draft CSAP	5 days	Tue 3/6/18	Mon 3/12/18																								
27	Revise and Submit Draft CSAP to EPA/IDEQ	5 days	Tue 3/13/18	Mon 3/19/18																								
28	Submit Draft 10-Acre Pond CSAP to EPA	0 days	Mon 3/19/18	Mon 3/19/18																								
29	EPA/IDEQ Review Draft CSAP	25 days	Tue 3/20/18	Mon 4/23/18																								
30	EPA/IDEQ comments on Draft CSAP	0 days	Mon 4/23/18	Mon 4/23/18																								
31	Revise, Finalize and Submit Final CSAP	5 days	Tue 4/24/18	Mon 4/30/18																								
32	EPA/IDEQ approval of Final CSAP	5 days	Tue 5/1/18	Mon 5/7/18																								
33	Final CSAP Approved	0 days	Mon 5/7/18	Mon 5/7/18																								
34	Contractor Procurement	53 days	Tue 3/20/18	Thu 5/31/18																								
35	Prepare and Submit Draft Procurement SOW	10 days	Tue 3/20/18	Mon 4/2/18																								
36	Submit Draft Procurement SOW to Multistate Trust	0 days	Mon 4/2/18	Mon 4/2/18																								
37	Multistate Trust Review of Draft Procurement SOW	5 days	Tue 4/3/18	Mon 4/9/18																								
38	Finalize Procurement SOW	2 days	Tue 4/10/18	Wed 4/11/18																								
39	Multistate Trust Reviews and Signs Procurement SOW	3 days	Thu 4/12/18	Mon 4/16/18																								
40	Signed Procurement SOW	0 days	Mon 4/16/18	Mon 4/16/18																								
41	Shortlist Contactors	5 days	Tue 4/24/18	Mon 4/30/18																								
42	Prequalify Bidders	5 days	Tue 5/1/18	Mon 5/7/18																								
43	Solicit Bids from Contractors	14 days	Tue 5/8/18	Fri 5/25/18																								
44	Site Walk	0 days	Tue 5/15/18	Tue 5/15/18																								



















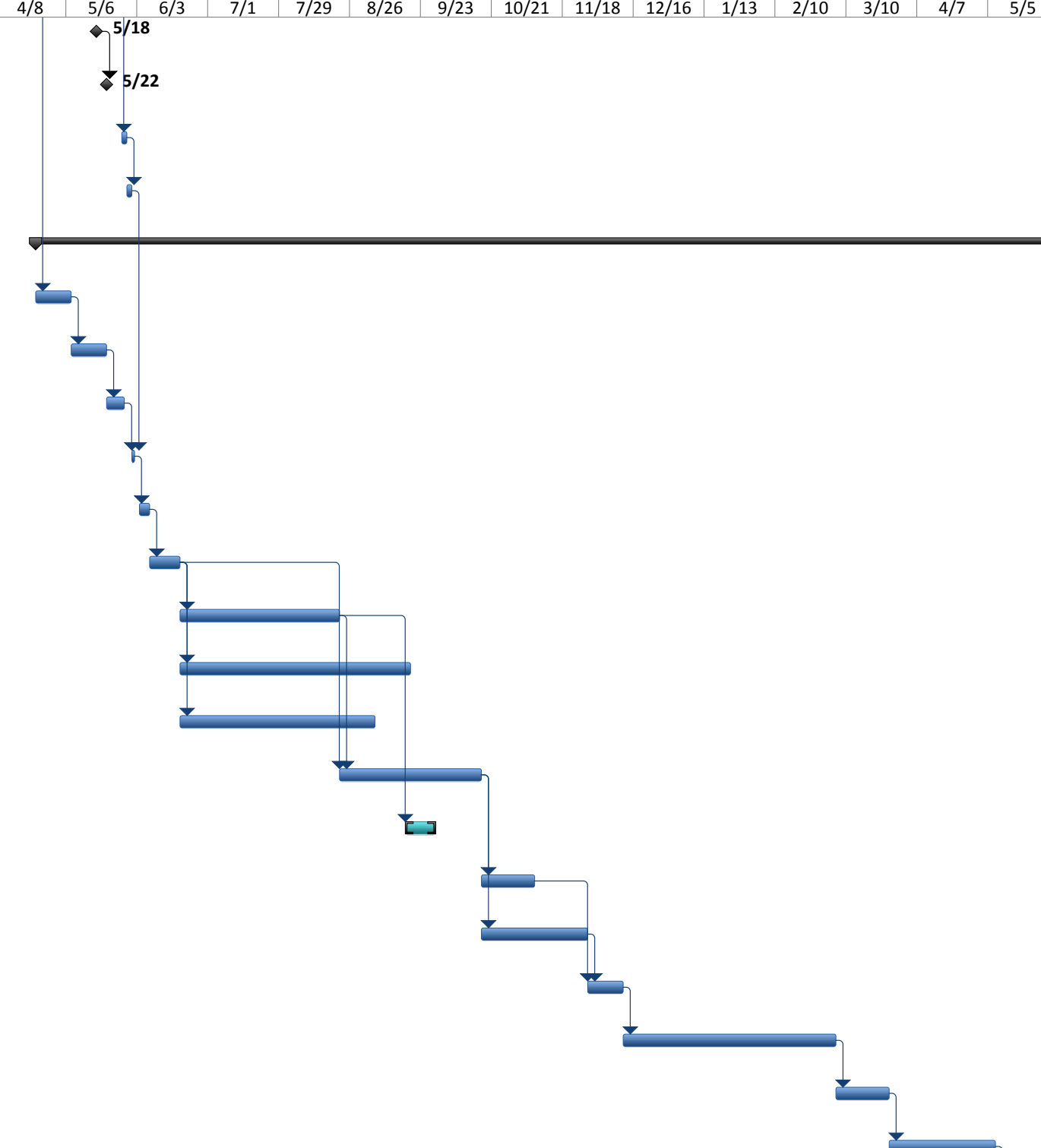
Project: 10-Acre Pond TCAM Project Date: Mon 3/5/18	Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
	Split		External Tasks		Inactive Summary		Manual Summary		Progress	
	Milestone		External Milestone		Manual Task		Start-only			
	Summary		Inactive Task		Duration-only		Finish-only			



















TABLE 7-1 - ENGINEERS SCHEDULE

ID	Task Name	Duration	Start	Finish	November 1			January 1		March 1		May 1		July 1		September 1		November 1		January 1		March 1		May 1								
					10/22	11/19	12/17	1/14	2/11	3/11	4/8	5/6	6/3	7/1	7/29	8/26	9/23	10/21	11/18	12/16	1/13	2/10	3/10	4/7	5/5							
45	Questions Due	0 days	Fri 5/18/18	Fri 5/18/18																												
46	Answers and Addenda Due	0 days	Tue 5/22/18	Tue 5/22/18																												
47	Review Bids	2 days	Mon 5/28/18	Tue 5/29/18																												
48	Select and Recommend Contractor	2 days	Wed 5/30/18	Thu 5/31/18																												
49	Implementation of Time-Critical Removal Action	286 days	Tue 4/24/18	Tue 5/28/19																												
50	Prepare And Submit Draft Construction SOW	10 days	Tue 4/24/18	Mon 5/7/18																												
51	Multistate Trust Review of Draft SOW	10 days	Tue 5/8/18	Mon 5/21/18																												
52	Prepare Draft Final Construction SOW	5 days	Tue 5/22/18	Mon 5/28/18																												
53	Incorporate Subcontractor Cost in Final SOW	1 day	Fri 6/1/18	Fri 6/1/18																												
54	Multistate Trust Reviews and Signs Construction SOW	4 days	Mon 6/4/18	Thu 6/7/18																												
55	Mobilization	8 days	Fri 6/8/18	Tue 6/19/18																												
56	Repository Base Construction	45 days	Wed 6/20/18	Tue 8/21/18																												
57	Pond Dewatering and Sediment Drying	65 days	Wed 6/20/18	Tue 9/18/18																												
58	Water Shipping Off Site	55 days	Wed 6/20/18	Tue 9/4/18																												
59	Placement of Pond Sediments in Repository	40 days	Wed 8/22/18	Tue 10/16/18																												
60	Confirmation Sampling of Pond Footprint	10 days	Mon 9/17/18	Fri 9/28/18																												
61	Reclamation of 10-Acre Pond Footprint	15 days	Wed 10/17/18	Tue 11/6/18																												
62	Install Repository Cap	30 days	Wed 10/17/18	Tue 11/27/18																												
63	Demobilization	10 days	Wed 11/28/18	Tue 12/11/18																												
64	Prepare Draft After Action Report	60 days	Wed 12/12/18	Tue 3/5/19																												
65	Multistate Trust Review of AAR	15 days	Wed 3/6/19	Tue 3/26/19																												
66	EPA Review of After Action Report	30 days	Wed 3/27/19	Tue 5/7/19																												

Project: 10-Acre Pond TCAM Project Date: Mon 3/5/18	Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
	Split		External Tasks		Inactive Summary		Manual Summary		Progress	
	Milestone		External Milestone		Manual Task		Start-only			
	Summary		Inactive Task		Duration-only		Finish-only			

TABLE 7-1 - ENGINEERS SCHEDULE

ID	Task Name	Duration	Start	Finish	November 1		January 1		March 1		May 1		July 1		September 1		November 1		January 1		March 1		May 1			
					10/22	11/19	12/17	1/14	2/11	3/11	4/8	5/6	6/3	7/1	7/29	8/26	9/23	10/21	11/18	12/16	1/13	2/10	3/10	4/7	5/5	
67	Finalize AAR	15 days	Wed 5/8/19	Tue 5/28/19	<div></div>																					

Project: 10-Acre Pond TCAM Project Date: Mon 3/5/18	Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
	Split		External Tasks		Inactive Summary		Manual Summary		Progress	
	Milestone		External Milestone		Manual Task		Start-only			
	Summary		Inactive Task		Duration-only		Finish-only			

## 8.0 REFERENCES

- Aero-Graphics, Inc., 2015. Former Tronox/KMCC Superfund Site Aerial Survey, Soda Springs, ID. Technical Project Report. November 14, 2015.
- Bonaparte, Rudolph, B.A. Gross, D.E. Daniel, R.M. Koerner, and S. Dwyer, 2004. (Draft) Technical Guidance for RCRA/CERCLA Final Covers. EPA-540-R-04-007. U.S. EPA, Washington, D.C.
- Koerner, Robert M., 2012. *Designing with Geosynthetics, 6<sup>th</sup> Ed. Vol 2*. Xlibris Corporation.
- Pioneer Technical Services, Inc.; Hydrometrics, Inc.; Haley & Aldrich, Inc., 2017. Evaluation of Need for 10-Acre Pond Sediment Disposal Landfill Liner – Draft. Landfill Liner Requirement Technical Memorandum. December 1, 2017.
- Tetra Tech, Inc., 2017. DRAFT Phase I and Phase II Supplemental Remedial Investigation Report, Former Tronox/Kerr-McGee Chemical Corporation Superfund Site, Soda Springs, ID. June 9, 2017.
- U.S. Army Corps of Engineers (USACE), 1997. Hydrologic Evaluation of Landfill Performance, Version 3.07. USACE Waterways Experiment Station. Vicksburg, MS.
- U.S. EPA, 1979. Recovery, Processing and Utilization of Gas from Sanitary Landfills. Lockman Associates and R.K. Han. EPA-600/2-79-001. U.S. EPA, Cincinnati, Ohio.
- U.S. EPA, 1988. CERCLA Compliance with Other Laws Manual: Interim Final. EPA-540/G-89/006. U.S. EPA, Washington, D.C.
- U.S. EPA, 2018. DRAFT Action Memorandum for a Time-Critical Removal Action for the 10-Acre Pond at the Kerr-McGee Chemical Corp. (KMCC) – Soda Springs Plant Superfund Site, Soda Springs, Caribou County, Idaho. From Kathryn Cerise, Remedial Project Manager. January 3, 2018.

## **APPENDIX A**

### **CONSTRUCTION DRAWINGS**



# 10-ACRE POND REMOVAL ACTION AT THE FORMER KERR-MCGEE SODA SPRINGS PLANT

## SODA SPRINGS, CARIBOU COUNTY, IDAHO

MAY 2018



SITE OWNER

GREENFIELD ENVIRONMENTAL MULTI STATE TRUST LLC  
TRUSTEE OF THE MULTISTATE ENVIRONMENTAL RESPONSE TRUST

DESIGN ENGINEER

HYDROMETRICS, INC.  
3020 BOZEMAN AVENUE  
HELENA, MT 59601

### DRAWING SHEET INDEX

SHEET	TITLE
1	COVER AND INDEX
2	FACILITY MAP
3	EXISTING CONDITIONS & PROJECT CONTROL
4	PROJECT LAYOUT
5	REPOSITORY EXCAVATION PLAN
6	REPOSITORY GRADING & WASTE PLACEMENT
7	REPOSITORY COVER SYSTEM PLAN
8	REPOSITORY COVER SYSTEM PROFILES
9	LEACHATE COLLECTION SYSTEM DETAILS
10	REPOSITORY DETAILS
11	MISCELLANEOUS DETAILS
12	10-ACRE POND AREA REGRADING PLAN
13	10-ACRE POND AREA REGRADING PROFILES

NO	BY	DATE	DESCRIPTION

SCALE VERIFICATION  
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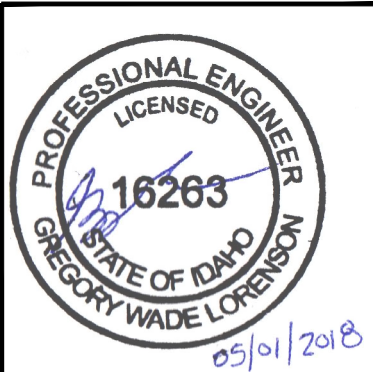


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3020 Bozeman Avenue  
(406) 443-4150

10-ACRE POND REMOVAL ACTION AT THE FORMER  
KERR-MCGEE SODA SPRINGS PLANT

COVER AND INDEX



DRAWING FILE NUMBER	1703401H001
AUTOCAD 2004 DRAWING (DWG)	
SHEET NUMBER	1
REV	





**SCALE**  
(In Feet)

150      0      150      300      450

**LEGEND**

- PROPERTY BOUNDARY
- - - APPROXIMATE ROAD EDGE
- EDGE OF PAVEMENT
- + + + RAILROAD TRACKS
- x - FENCE
- BUILDING AND CONCRETE PAD

**NOTE:**  
1. THE EXISTING LANDFILL HAS ALSO BEEN REFERRED TO AS THE "RCRA LANDFILL" IN THE VARIOUS SITE DOCUMENTS. THERE IS NO RCRA PERMIT FOR THE SITE. HOWEVER, THE TERM "RCRA LANDFILL" HAS HISTORICALLY BEEN USED BECAUSE THIS WASTE REPOSITOR WAS REPORTEDLY DESIGNED AND CONSTRUCTED TO MEET RCRA SUBTITLE D DESIGN STANDARDS.

**FACILITY MAP**  
SCALE: 1" = 150'

REVISIONS	NO	BY	DATE	DESCRIPTION

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CHECKED BY	MWR	04/26/18
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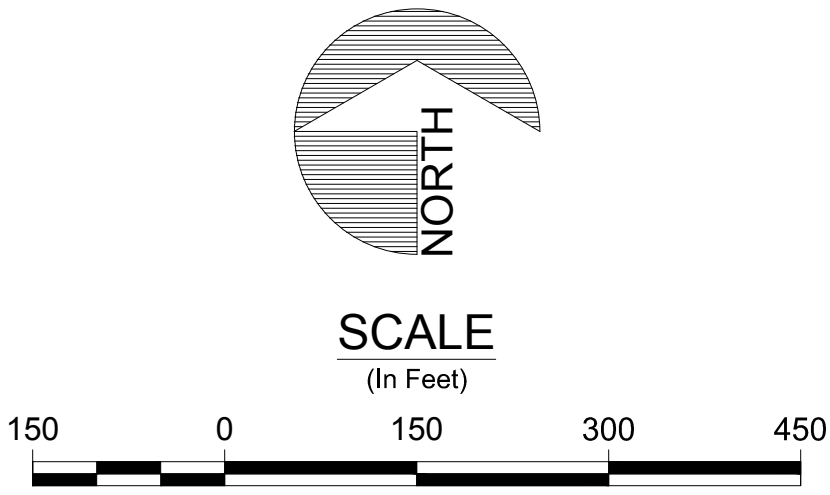
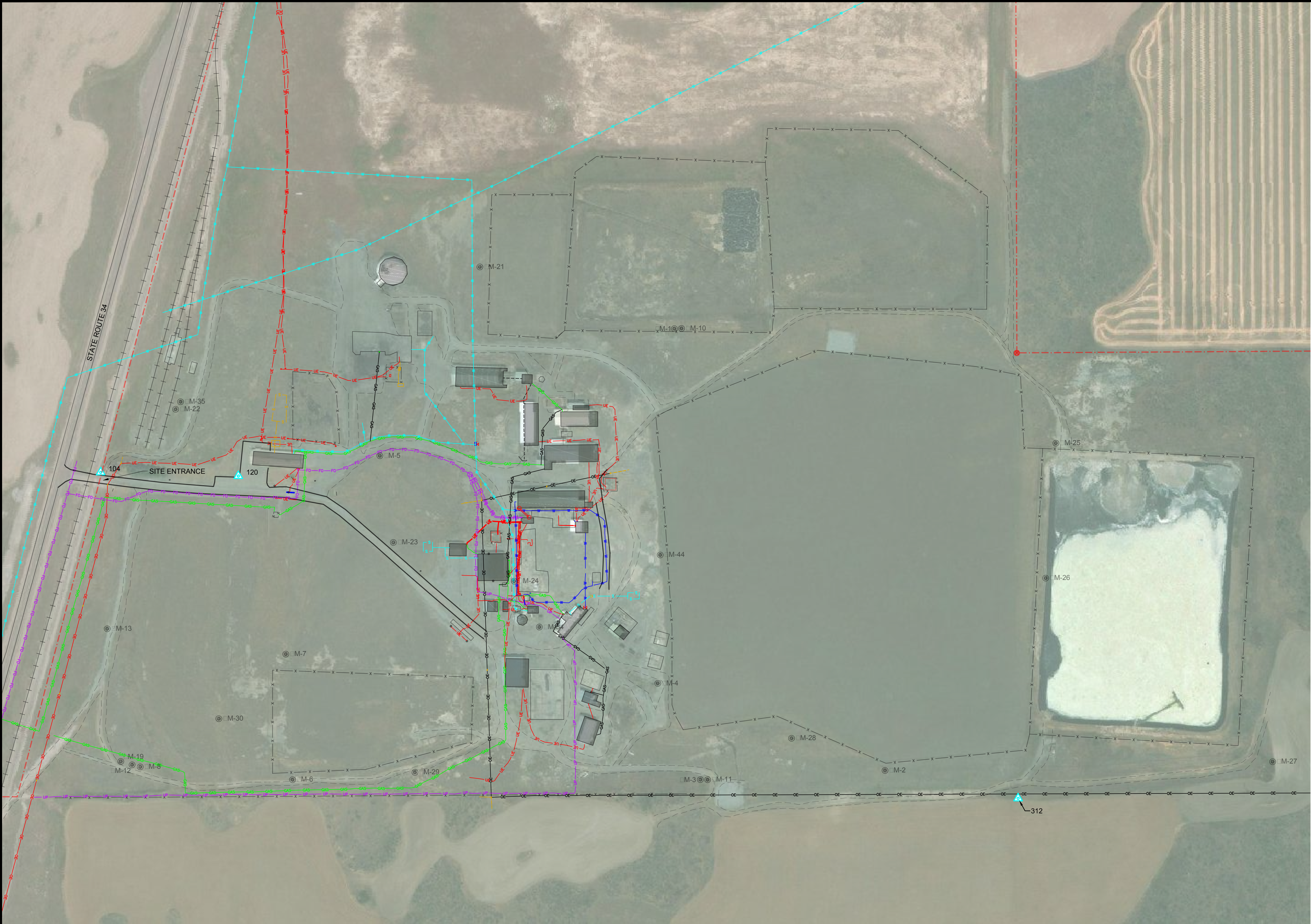
10-ACRE POND REMOVAL ACTION AT THE FORMER  
KERR-MCGEE SODA SPRINGS PLANT

**FACILITY MAP**

DRAWING FILE NUMBER  
1703401H004  
AUTOCAD 2004 DRAWING (DWG)  
SHEET NUMBER  
**2**

REV





- LEGEND**
- PROPERTY BOUNDARY
  - APPROXIMATE ROAD EDGE
  - EDGE OF PAVEMENT
  - RAILROAD TRACK
  - FENCE
  - BUILDING AND CONCRETE PAD
  - SEPTIC AND DRAINFIELD
  - WATERLINE
  - ASSUMED WATERLINE
  - UNDERGROUND GAS LINE
  - ASSUMED GAS MAIN
  - UNDERGROUND ELECTRICAL LINE
  - ABOVE GROUND ELECTRICAL LINE
  - UNDERGROUND TELEPHONE LINE
  - ABOVE GROUND TELEPHONE LINE
  - UNDERGROUND FIBER OPTIC LINE
  - ELECTRICAL SUBSTATION
  - FIRE HYDRANT
  - POWER POLE - GU
  - SIGNS
  - LIGHT
  - POWER BOX
  - UNDERGROUND PIPE
  - SEPTIC TANK
  - WATER VALVE
  - EXISTING MONITORING WELL
  - CONTROL POINT (SEE TABLE)

- NOTES:**
- NOT ALL UTILITY LOCATIONS ARE CONFIRMED. ADDITIONAL UTILITIES MAY EXIST.
  - DEMOLITION CONTRACT MAY CHANGE CONDITIONS, INCLUDING BUT NOT LIMITED TO WORK DESCRIBED IN THE CONTRACT DOCUMENTS.

SURVEY CONTROL				
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
104	372616.92	813972.17	5980.26	CP-GIN SP
105	375405.12	814833.04	6000.41	CP-GIN SP
108	374287.05	816734.97	6058.64	CP-GIN SP
120	372605.90	814385.10	5997.42	CP-AC
312	371638.87	816724.32	6032.08	1/16 AC

- SURVEY NOTES:**
- CONTROL POINTS REFERENCE IDAHO STATE PLANE (NAD 83), EAST ZONE, US FOOT.
  - CONTROL POINTS 105 AND 108 ARE NOT SHOWN ON THIS SHEET.

**EXISTING CONDITIONS**

SCALE: 1" = 150'

NO	BY	DATE	DESCRIPTION

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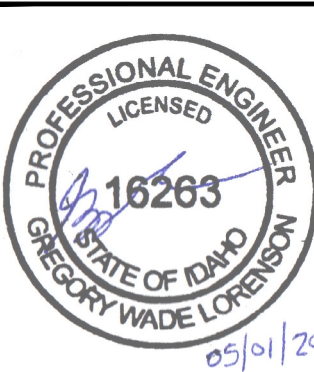
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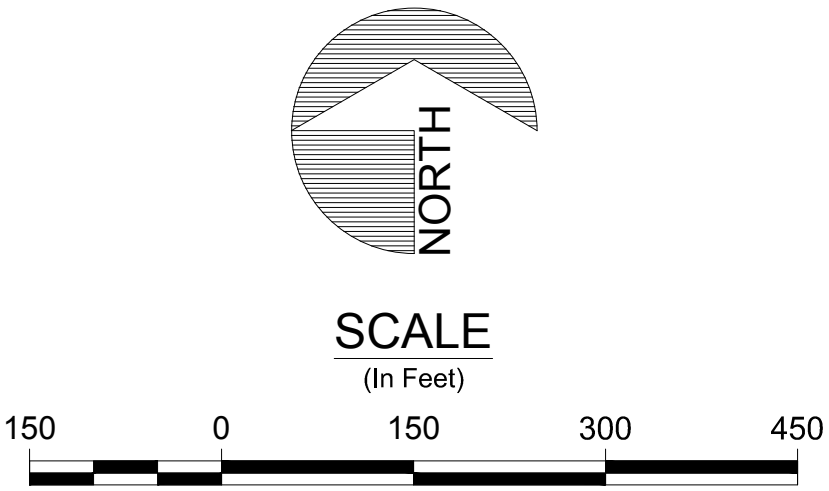
**10-ACRE POND REMOVAL ACTION AT THE FORMER  
KERR-MCGEE SODA SPRINGS PLANT**

**EXISTING CONDITIONS & PROJECT CONTROL**



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AUTOCAD 2004 DRAWING (DWG)	
SHEET NUMBER	REV
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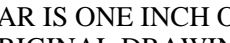


- LEGEND**
- PROPERTY BOUNDARY
  - - - - - APPROXIMATE ROAD EDGE
  - EDGE OF PAVEMENT
  - RAILROAD TRACKS
  - x - x - FENCE
  - BUILDING AND CONCRETE PAD
  - EXISTING GROUND SURFACE CONTOUR
  - o - o - PROPOSED TEMPORARY SILT FENCE FOR 10-ACRE POND REGRADING
  - PROPOSED WATER LINE (BOTH OTHERS)
  - PROPOSED FIRE HYDRANT (BOTH OTHERS)
  - PROPOSED ON-SITE REPOSITORY AREA
  - 10-ACRE POND
  - PROPOSED EXCAVATION STOCKPILE
  - PROPOSED SOUTH BORROW AREA
  - PROPOSED STAGING AREA
  - PROPOSED ACCESS ROAD (BOTH OTHERS)
  - PROPOSED HAUL ROAD (BOTH OTHERS)

- NOTES:**
1. INSTALL SILT FENCE AND OTHER BMPs TO SUIT ACTUAL CONDITIONS DURING EARTHWORK ACTIVITIES AND AS DIRECTED.
  2. DEMOLITION CONTRACTOR WILL ESTABLISH BMPs FOR REPOSITORY EXCAVATION PRIOR TO THIS CONTRACT. MAINTAIN BMPs DURING REPOSITORY CONSTRUCTION.
  3. DEMOLITION CONTRACTOR WILL CONSTRUCT PROPOSED ROADS, WATER LINE, AND HYDRANTS PRIOR TO THIS CONTRACT. PROPOSED ROAD LOCATIONS ARE APPROXIMATE AND SUBJECT TO CHANGE.
  4. GENERAL CONSTRUCTION SEQUENCE:
    - 4.1. PREPARE SUBGRADE AND INSTALL REPOSITORY BOTTOM LINER SYSTEM AND LEACHATE COLLECTION AND REMOVAL SYSTEM (LCRS).
    - 4.2. ACCEPT AND PLACE CALCINE CUSHION FROM THE DEMOLITION SUBCONTRACTOR.
    - 4.3. DISPOSE OF 10-ACRE POND LIQUID AND DRUM POND SOLIDS.
    - 4.4. ACCEPT AND PLACE WASTE FROM DEMOLITION SUBCONTRACTOR.
    - 4.5. HAUL POND SOLIDS TO REPOSITORY.
    - 4.6. HAUL POND LINER AND SUBGRADE SOIL TO REPOSITORY.
    - 4.7. REGRADE 10-ACRE POND AREA (COORDINATE WITH CONFIRMATION SAMPLING (BOTH OTHERS)).
    - 4.8. COMPLETE WASTE PLACEMENT AND INSTALL REPOSITORY COVER LINER SYSTEM.
    - 4.9. INSTALL COVER SOILS.

**PROJECT LAYOUT**  
SCALE: 1" = 150'

REVISIONS	NO	BY	DATE	DESCRIPTION

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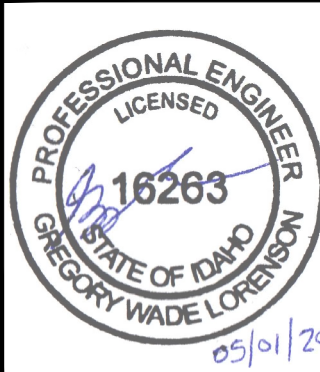


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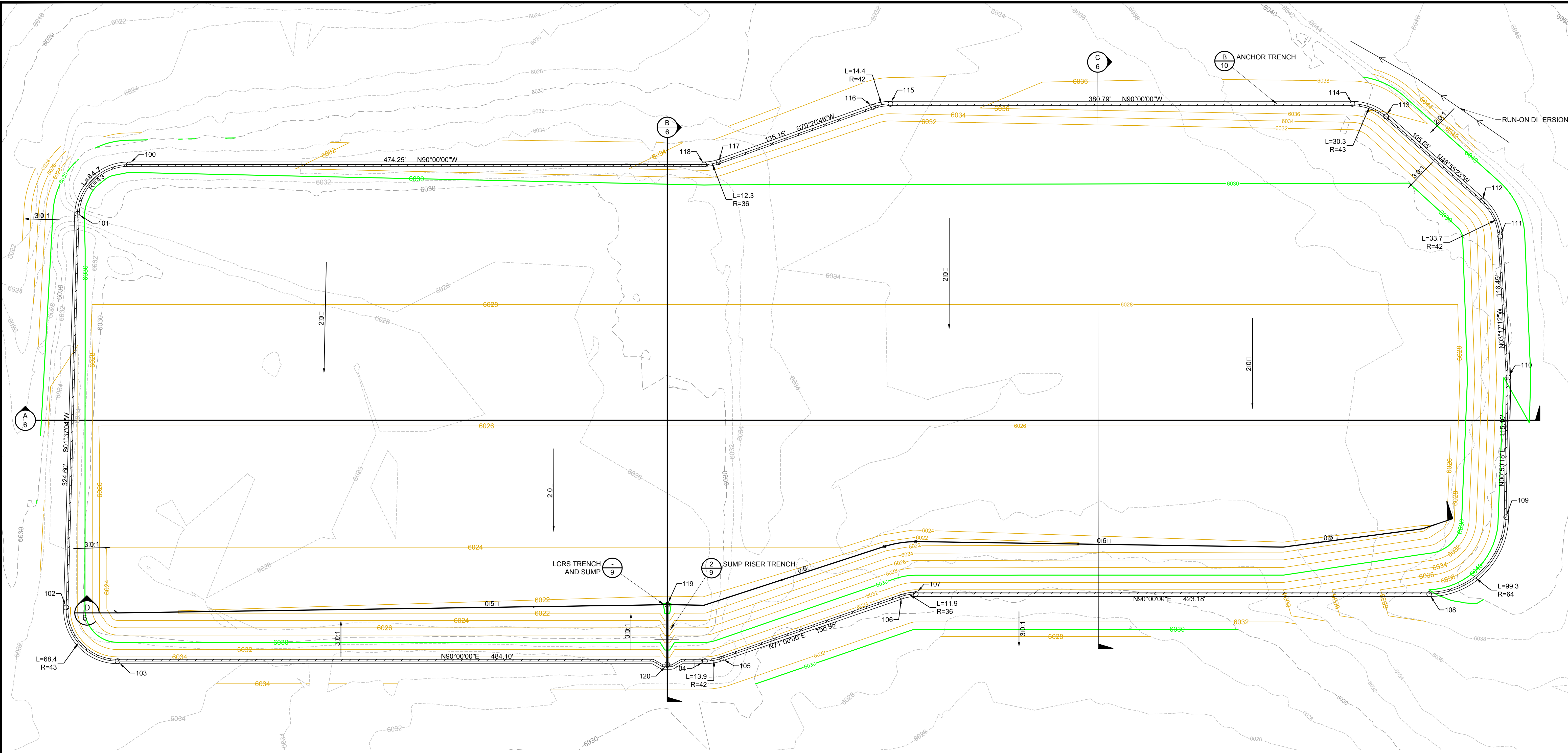
10-ACRE POND REMOVAL ACTION AT THE FORMER  
KERR-MCGEE SODA SPRINGS PLANT

**PROJECT LAYOUT**



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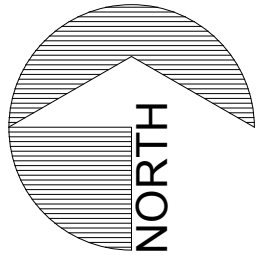




REPOSITORY EXCAVATION PLAN

SCALE: 1" = 40'

- NOTES:
- 1. EXISTING GROUND SHOWN REPRESENTS CURRENT CONDITIONS. MASS EXCAVATION TO BE COMPLETED BY OTHERS TO WITHIN 0.2-FEET OF FINAL REPOSITORY SUBGRADE. MASS EXCAVATION BY OTHERS WILL BE COMPLETE PRIOR TO THE START OF WORK UNDER THIS CONTRACT.
  - 2. SCRAP LINER MATERIALS ARE CURRENTLY LOCATED WITHIN THE FOOTPRINT OF THE REPOSITORY AND WILL BE RELOCATED BY OTHERS TO THE NORTH END OF THE 10-ACRE POND PRIOR TO THE START OF WORK UNDER THIS CONTRACT.
  - 3. PERFORM FINE GRADING, COMPACTION, AND GEOSYNTHETIC SUBGRADE PREPARATION, AS SPECIFIED.
  - 4. RUNOFF WILL ROUTE TO EXISTING LOW AREAS ON SITE. TEMPORARY EROSION AND SEDIMENT CONTROL SHALL BE ESTABLISHED PRIOR TO THE START OF WORK.



SCALE

(In Feet)



LEGEND

- EXISTING GROUND SURFACE CONTOURS (FEET)
- PROPOSED SURFACE CONTOURS (FEET)
- BOTTOM LINER ANCHOR TRENCH

POINT TABLE				
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
100	373472.80	815452.74	6030.95	TOP ANCHOR TRENCH
101	373432.24	815410.36	6030.95	TOP ANCHOR TRENCH
102	373107.77	815401.20	6033.95	TOP ANCHOR TRENCH
103	373063.53	815443.58	6033.95	TOP ANCHOR TRENCH
104	373063.53	815927.68	6033.95	TOP ANCHOR TRENCH
105	373065.82	815941.37	6033.95	TOP ANCHOR TRENCH
106	373116.92	816089.77	6033.95	TOP ANCHOR TRENCH
107	373118.88	816101.47	6033.95	TOP ANCHOR TRENCH
108	373118.88	816524.65	6039.95	TOP ANCHOR TRENCH
109	373182.24	816588.07	6040.95	TOP ANCHOR TRENCH
110	373297.32	816589.75	6039.95	TOP ANCHOR TRENCH

POINT TABLE				
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
111	373413.58	816583.07	6039.07	TOP ANCHOR TRENCH
112	373443.04	816588.64	6038.83	TOP ANCHOR TRENCH
113	373512.39	816489.08	6038.05	TOP ANCHOR TRENCH
114	373522.80	816461.29	6037.86	TOP ANCHOR TRENCH
115	373522.80	816080.50	6035.49	TOP ANCHOR TRENCH
116	373520.35	816066.35	6035.40	TOP ANCHOR TRENCH
117	373474.89	815939.08	6034.49	TOP ANCHOR TRENCH
118	373472.80	815926.99	6034.40	TOP ANCHOR TRENCH
119	373110.03	815896.68	6020.00	IE SUMP
120	373060.97	815896.68	6033.91	IE SUMP PIPE DAP LIGHT

REVISIONS	NO	BY	DATE	DESCRIPTION

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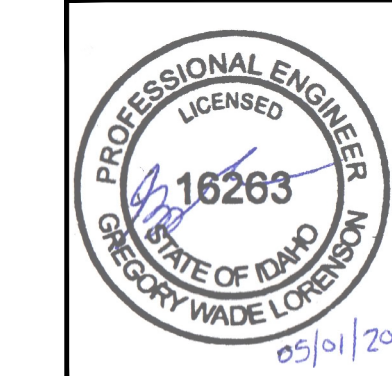
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10-ACRE POND REMOVAL ACTION AT THE FORMER  
KERR-MCGEE SODA SPRINGS PLANT

**REPOSITORY EXCAVATION PLAN**

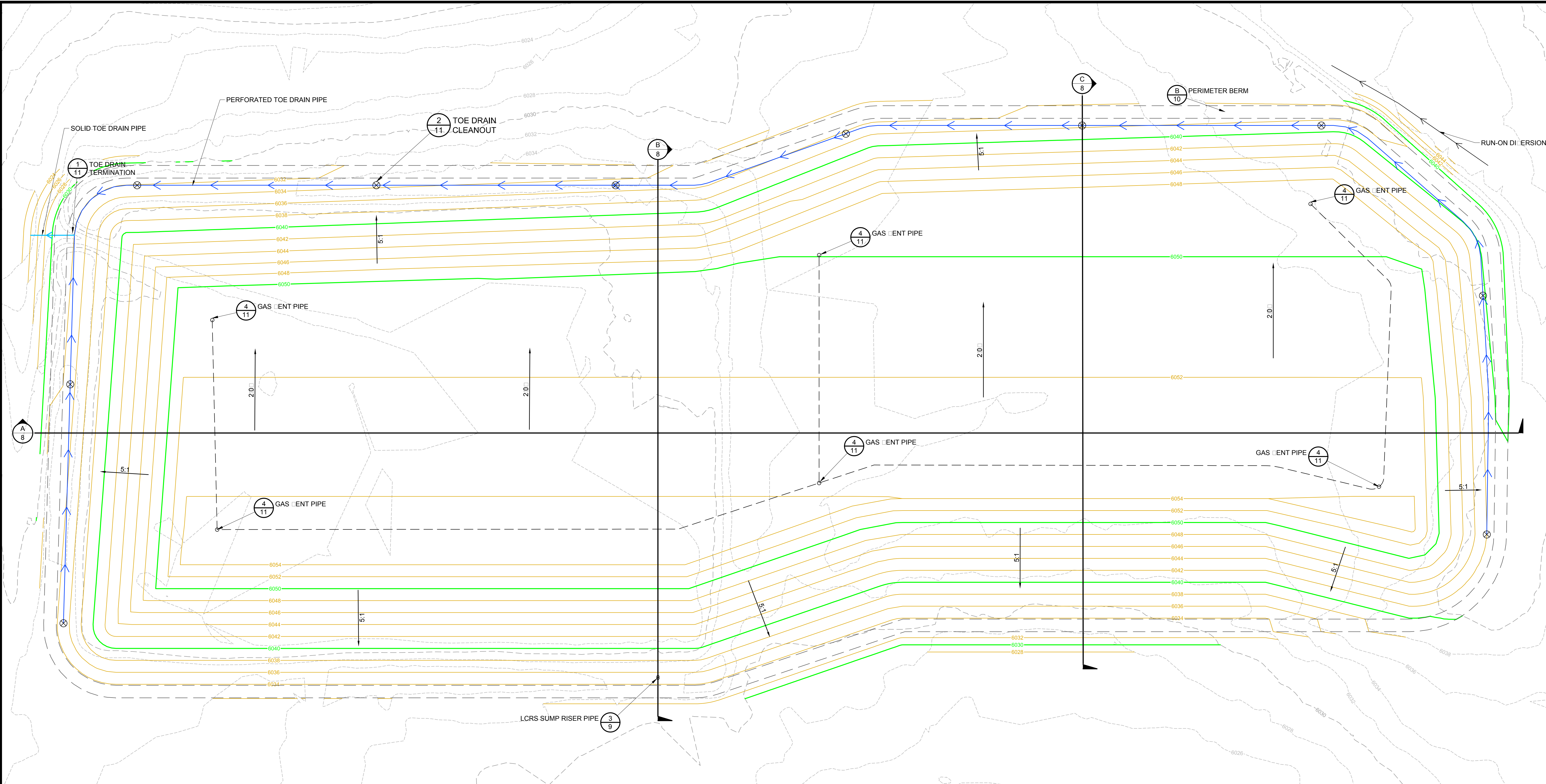


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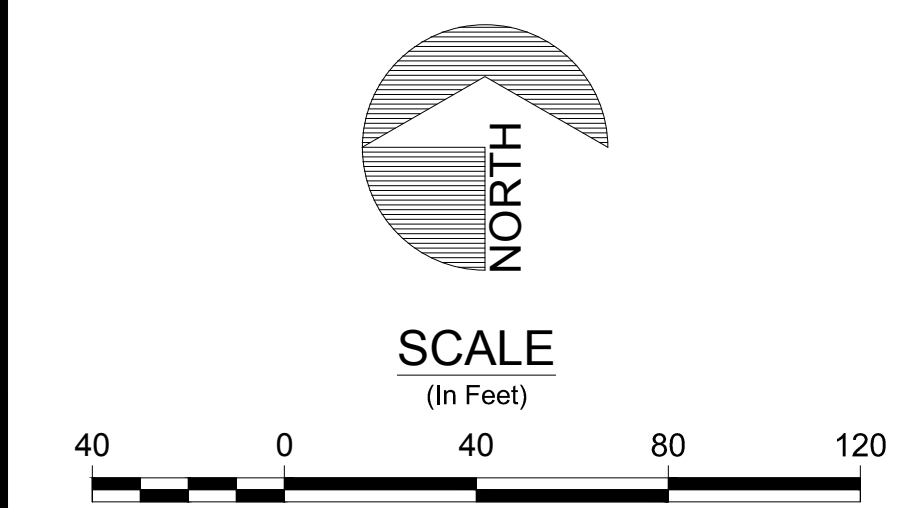








REPOSITORY COVER SYSTEM PLAN  
SCALE: 1" = 40'




- LEGEND**
- EXISTING GROUND SURFACE CONTOURS (FEET)
  - PROPOSED SURFACE CONTOURS (FEET)
  - PERIMETER BERM
  - GAS COLLECTION PIPE
  - PERFORATED TOE DRAIN PIPE
  - SOLID TOE DRAIN PIPE
  - TOE DRAIN CLEANOUT

- NOTES:**
- ADJUST COVER SOIL GRADE BASED ON FINAL COVER LINER GRADE. SOIL COVER SHALL BE 2' PERPENDICULAR TO THE SLOPE.
  - PERIMETER BERM WIDTH SHALL BE 10' MINIMUM ONCE COVER SOIL IS IN PLACE.
  - GAS COLLECTION AND DISCHARGE PIPE LOCATIONS ARE APPROXIMATE. SET BACK APPROXIMATELY 25' FROM EDGE OF SLOPE.
  - MEET MANUFACTURER'S RECOMMENDED MINIMUM RADIUS FOR ALL PIPE BENDS.
  - CONSTRUCT TOE DRAINS ALONG EAST, NORTH, AND WEST TOE AS SHOWN. MINIMUM PIPE SLOPE IS 0.5%.
  - TOE DRAIN CLEANOUT LOCATIONS ARE APPROXIMATE. INSTALL CLEANOUTS AT THE BEGINNING OF EACH PERFORATED TOE DRAIN PIPE AND SPACED NO MORE THAN 200' APART. THE SOLID TOE DRAIN DISCHARGE PIPE DOES NOT REQUIRE A CLEANOUT.
  - ADJUST COVER SOIL GRADING AROUND LCRS SUMP RISER PIPE AS SHOWN ON SHEET 11 AND AS DIRECTED.
  - SURFACE RUNOFF WILL TEMPORARILY ROUTE TO LOW AREAS ADJACENT TO THE REPOSITORY. THE DEMOLITION CONTRACTOR WILL INCORPORATE THESE AREAS INTO A SITE-WIDE REGRADING EFFORT AFTER DEMOLITION IS COMPLETED.

REVISIONS	NO	BY	DATE	DESCRIPTION

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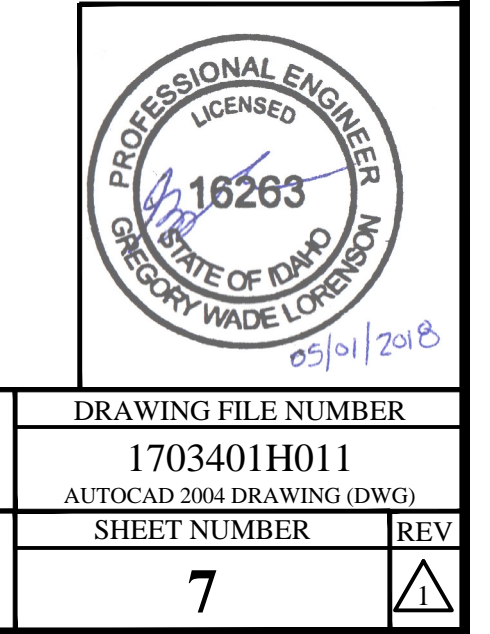
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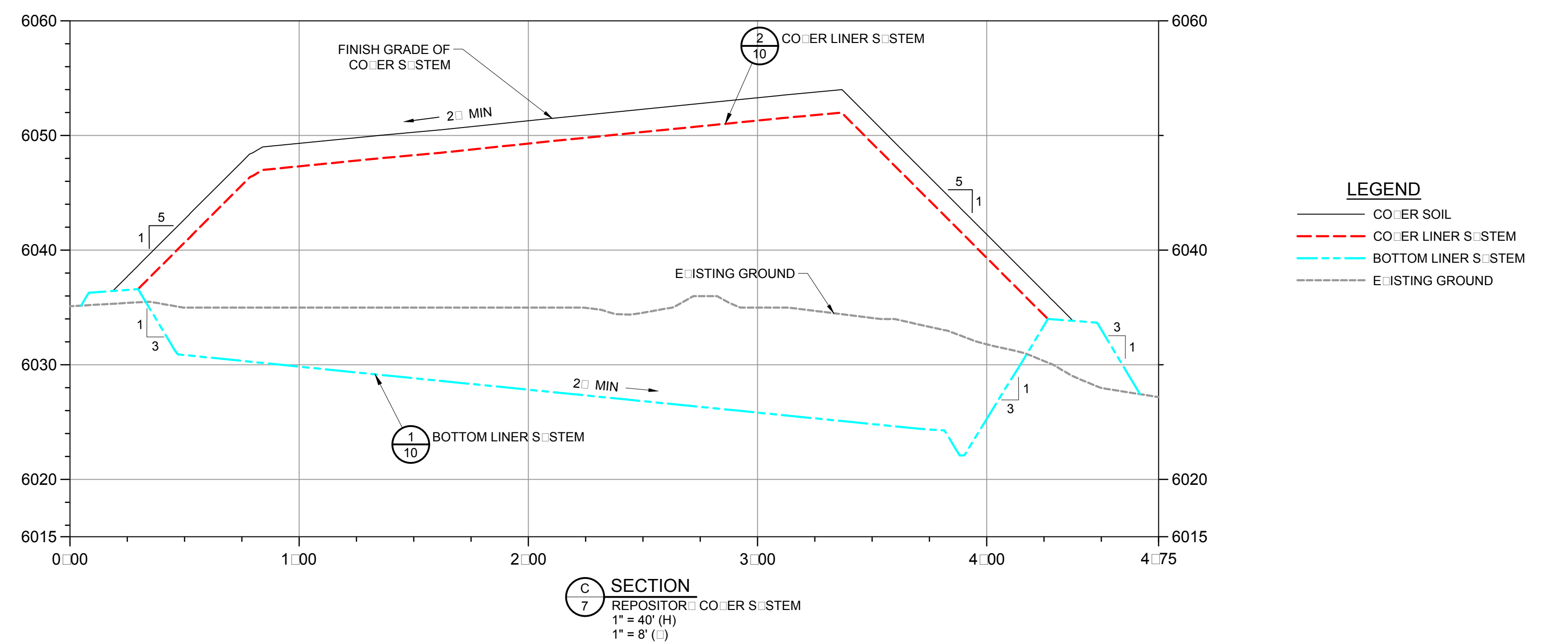
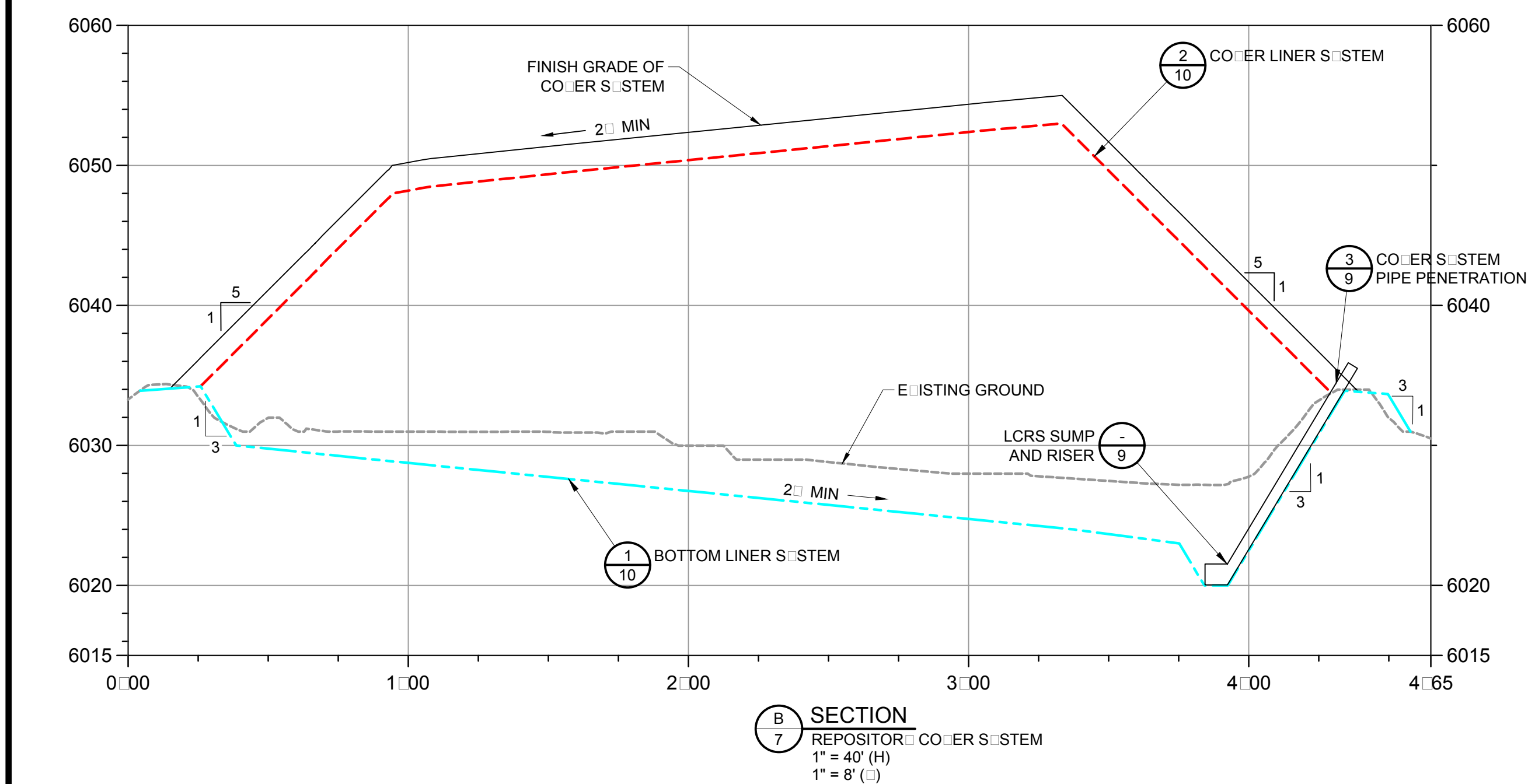
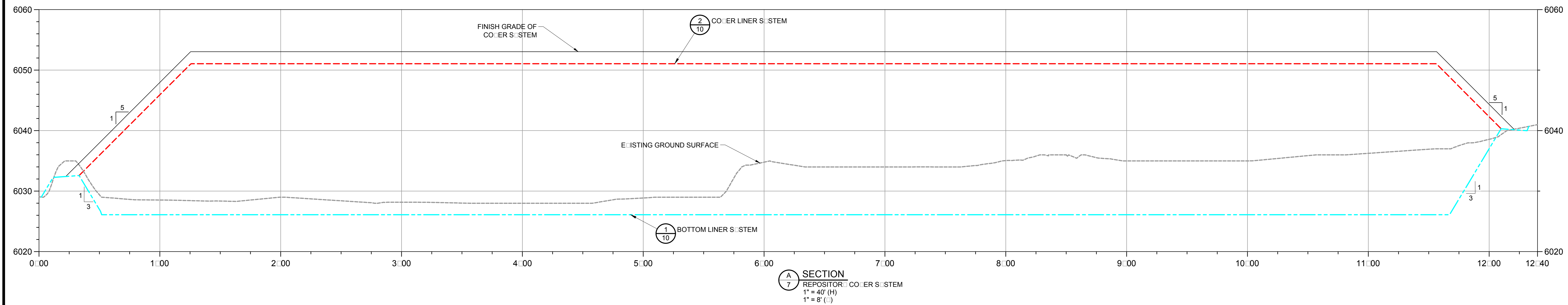
10-ACRE POND REMOVAL ACTION AT THE FORMER  
KERR-MCGEE SODA SPRINGS PLANT

**REPOSITORY COVER SYSTEM PLAN**



DRAWING FILE NUMBER  
1703401H011  
AUTOCAD 2004 DRAWING (DWG)  
SHEET NUMBER  
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- LEGEND**
- COILER SOIL
  - COILER LINER SYSTEM
  - BOTTOM LINER SYSTEM
  - EXISTING GROUND

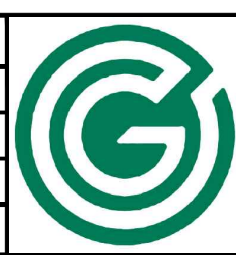
**CONSTRUCTION SEQUENCE:**

1. PREPARE THE REPOSITORY COILER LINER SYSTEM SUBGRADE BY INSTALLATION OF THE CALCINE CUSHION / GAS MIGRATION LAYER AND ASSOCIATED GAS EMENT PIPING
2. INSTALL THE COILER LINER SYSTEM, INCLUDING THE ANCHOR TRENCHES
3. INSTALL THE PERIMETER TOE DRAINS AND BACKFILL THE ANCHOR TRENCHES
4. PLACE THE COILER SUBSOIL AND GROWTH MEDIA

NO	BY	DATE	DESCRIPTION

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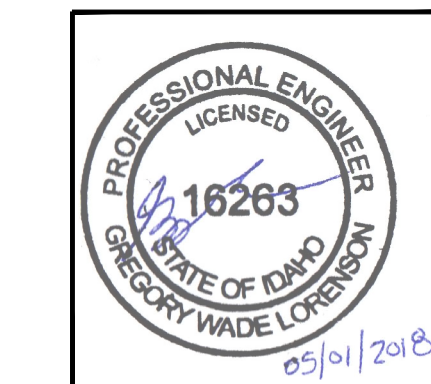


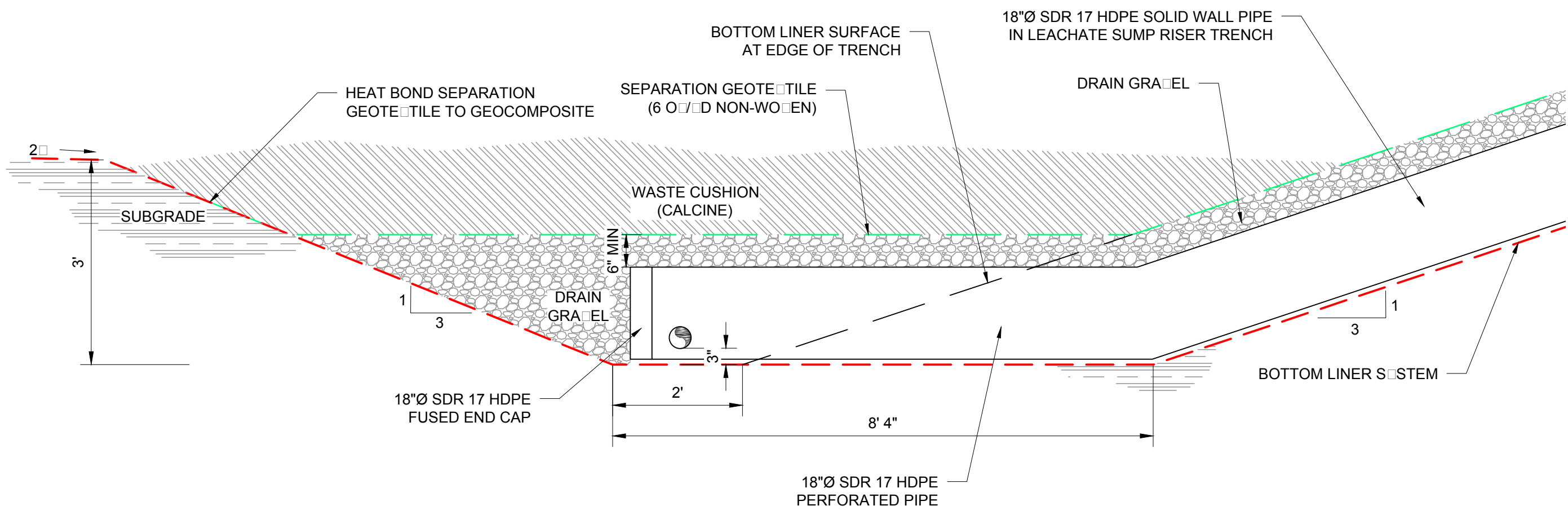
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10-ACRE POND REMOVAL ACTION AT THE FORMER KERR-MCGEE SODA SPRINGS PLANT
REPOSITORY COVER SYSTEM PROFILES

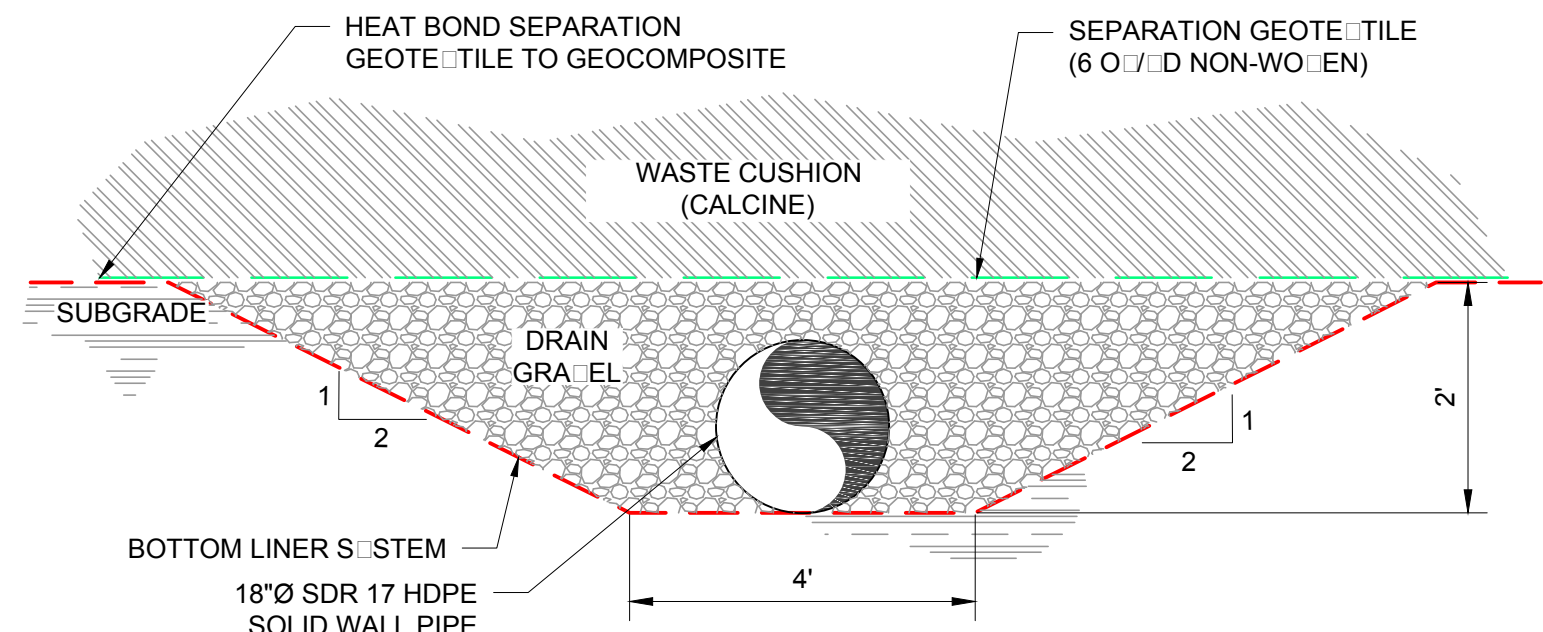
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SHEET NUMBER 8	



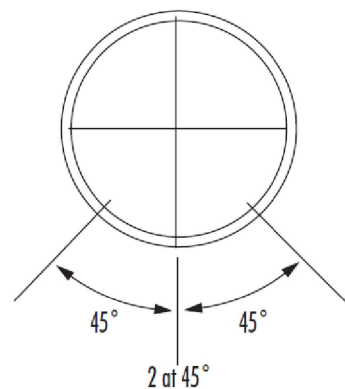
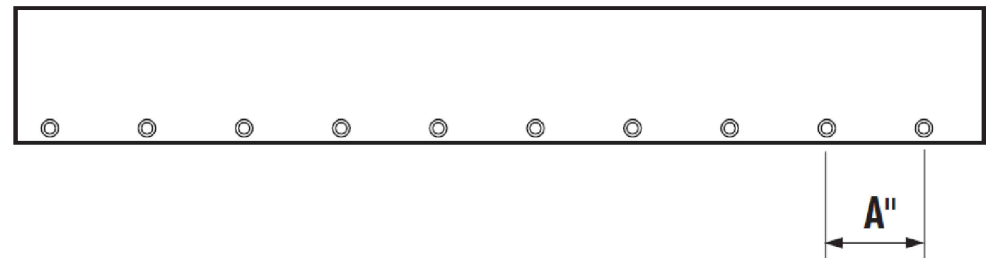


- NOTES:
1. DRAIN PIPES CONNECT TO RISER PIPE FROM BOTH SIDES.
  2. SEPARATION GEOTEXTILE SHALL EXTEND UP THE LINER SYSTEM SLOPES A MINIMUM OF 6" BEYOND THE DRAIN GRATE. HEAT BOND OR OTHERWISE SECURE THE GEOTEXTILE TO THE GEOCOMPOSITE.

1 DETAIL  
LEACHATE SUMP AND RISER PIPE  
NTS

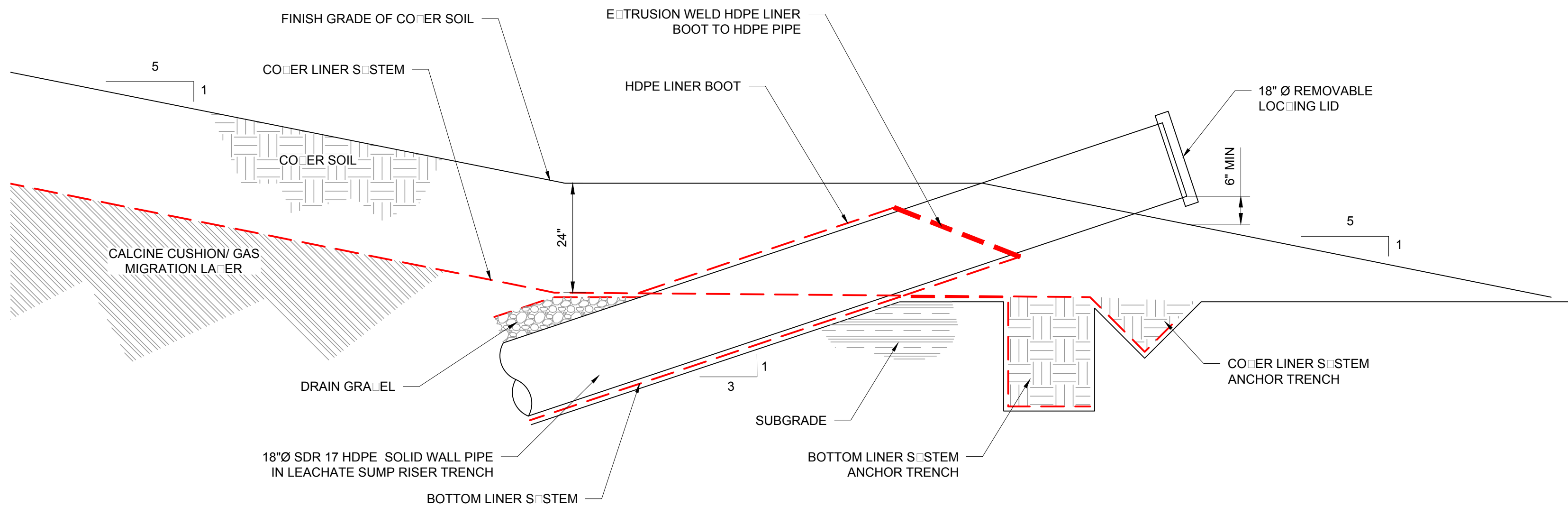


2 DETAIL  
LEACHATE SUMP RISER TRENCH  
NTS

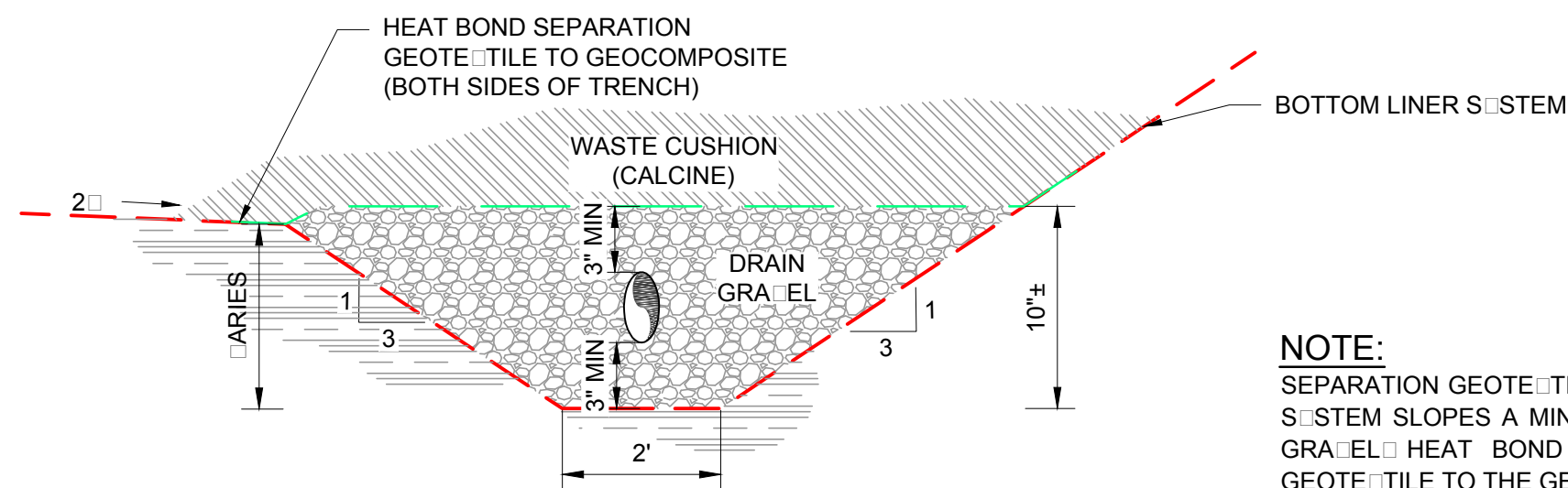


- NOTES:
1. THE SDR 17 HDPE PIPE MAY BE PERFORATED IN THE FIELD. THE HOLE DIAMETER SHALL BE 3/4" AND THE SPACING (A") SHALL BE 6 INCHES MAX.
  2. PERFORM THE HORIZONTAL PORTION OF PIPE LOCATED ON THE SUMP BOTTOM. DO NOT PERFORM THE SLOPED PIPE IN THE RISER TRENCH.

4 DETAIL  
LEACHATE SUMP PIPE PERFORATIONS  
NTS

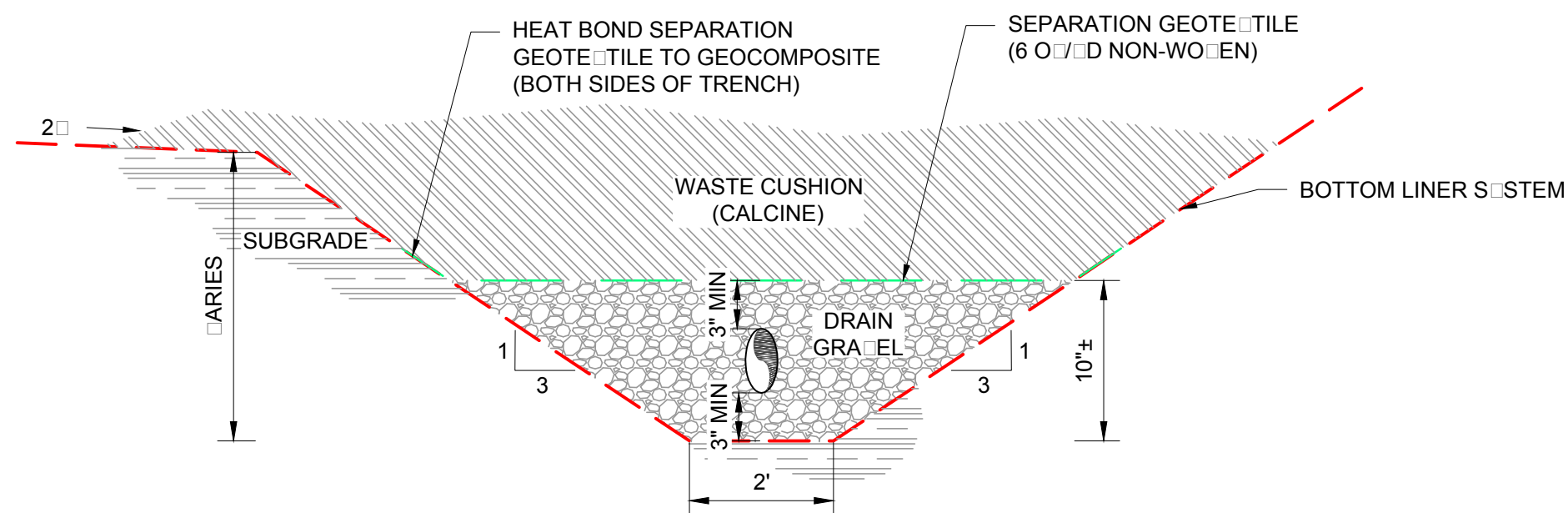


3 DETAIL  
COILER SYSTEM PIPE PENETRATION  
NTS



A SECTION  
LEACHATE COLLECTION TRENCH ENDS  
NTS (VERTICAL ENLARGEMENT)

- NOTE:
- SEPARATION GEOTEXTILE SHALL EXTEND UP THE LINER SYSTEM SLOPES A MINIMUM OF 6" BEYOND THE DRAIN GRATE. HEAT BOND OR OTHERWISE SECURE THE GEOTEXTILE TO THE GEOCOMPOSITE.



B SECTION  
LEACHATE COLLECTION TRENCH (TYPICAL)  
NTS (VERTICAL ENLARGEMENT)

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APPROVED BY	GWL 04/26/18
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Multistate Trust LLC,  
Trustee of the Multistate  
Environmental Response Trust

Hydrometrics, Inc.  
Consulting Scientists and Engineers

Helena, Montana 59601  
3020 Bozeman Avenue  
(406) 443-4150

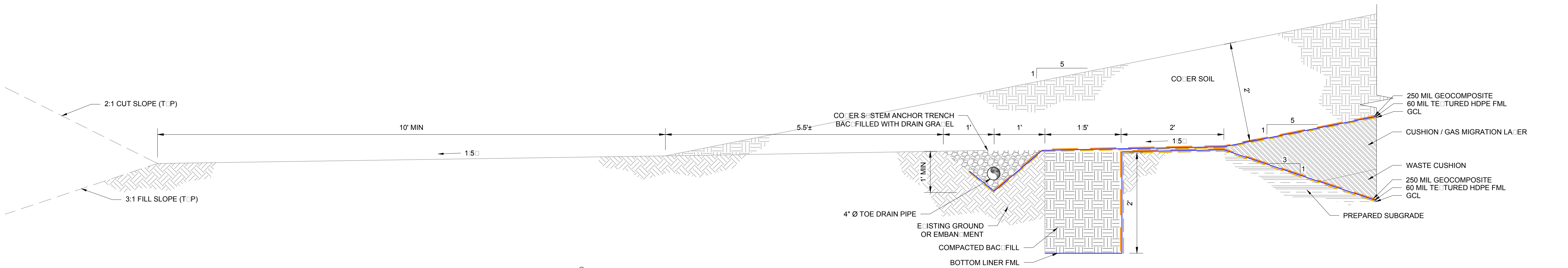
10-ACRE POND REMOVAL ACTION AT THE FORMER  
KERR-MCGEE SODA SPRINGS PLANT

LEACHATE COLLECTION SYSTEM DETAILS



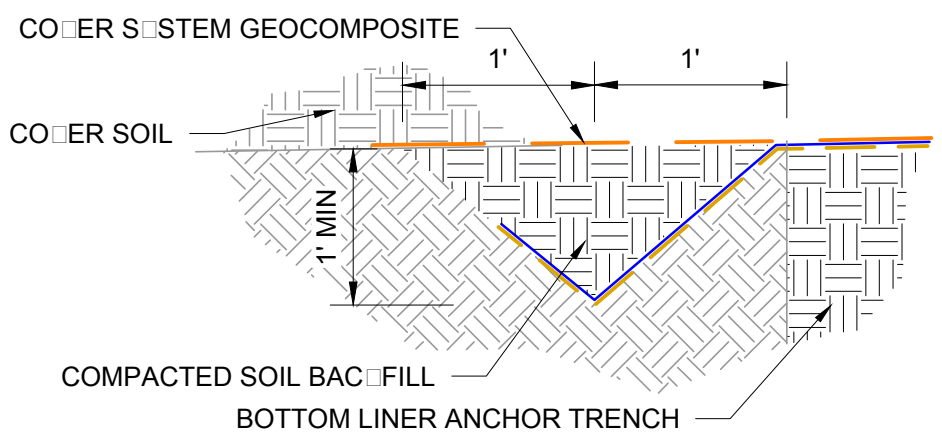
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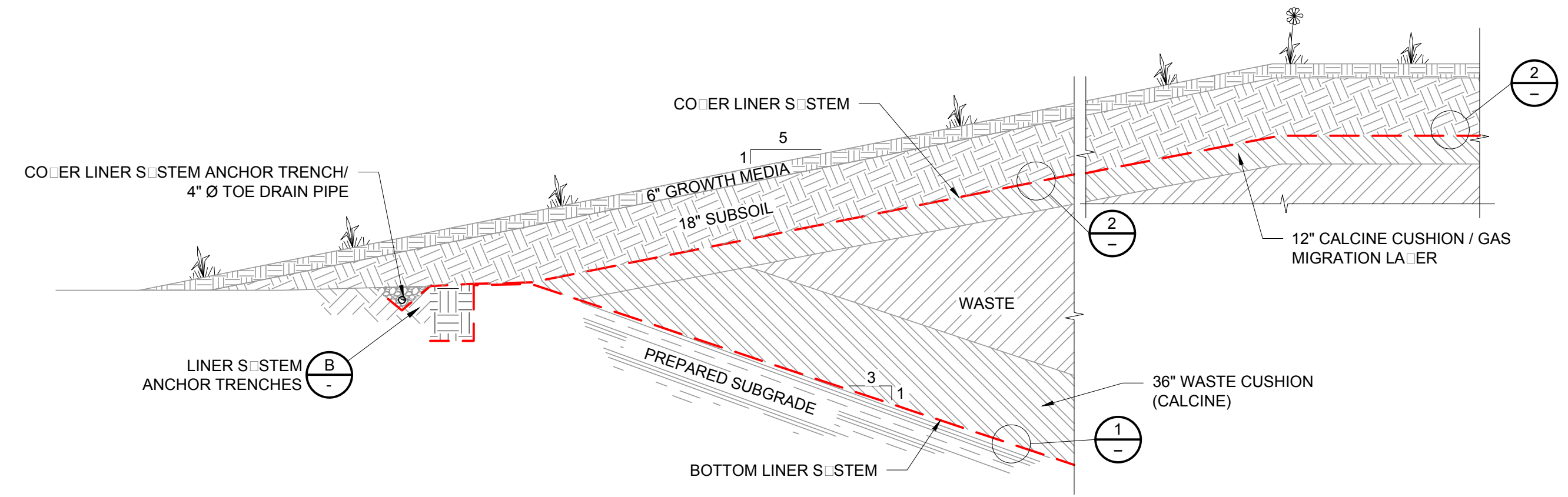


**B SECTION**  
REPOSITORY PERIMETER AND ANCHOR TRENCHES  
NTS

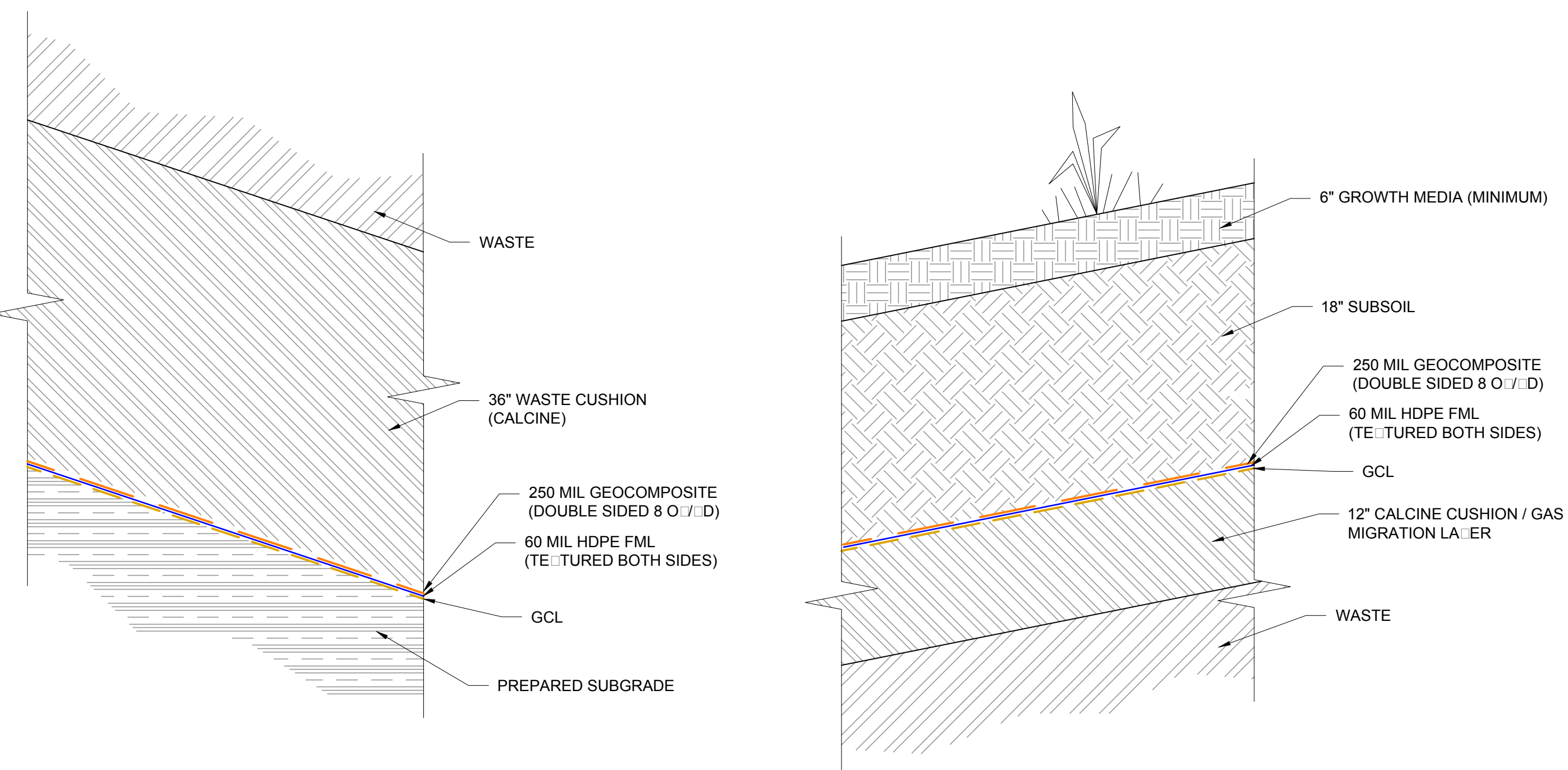
- NOTES:**
1. PRIOR TO BACKFILLING ANCHOR TRENCH, REMOVE ALL LINER SCRAPS, TEMPORARY BALLAST (SANDBAGS), AND OTHER DELETERIOUS DEBRIS. COMPACT ANCHOR TRENCH BACKFILL AS SPECIFIED.
  2. CENTER TOE DRAIN PIPE IN DRAIN GRAVEL.
  3. INSTALL TOE DRAIN WHERE SHOWN ON COILER SOIL PLAN SHEET. OMIT DRAIN GRAVEL AND PIPE WHERE NOT SHOWN AND PLACE AND COMPACT SOIL BACKFILL IN COILER SYSTEM ANCHOR TRENCH WHERE COILER SYSTEM ANCHOR TRENCH IS BACKFILLED WITH SOIL, DO NOT ANCHOR GEOCOMPOSITE BUT EXTEND GEOCOMPOSITE BEYOND THE ANCHOR TRENCH, AS SHOWN IN THE DETAIL.



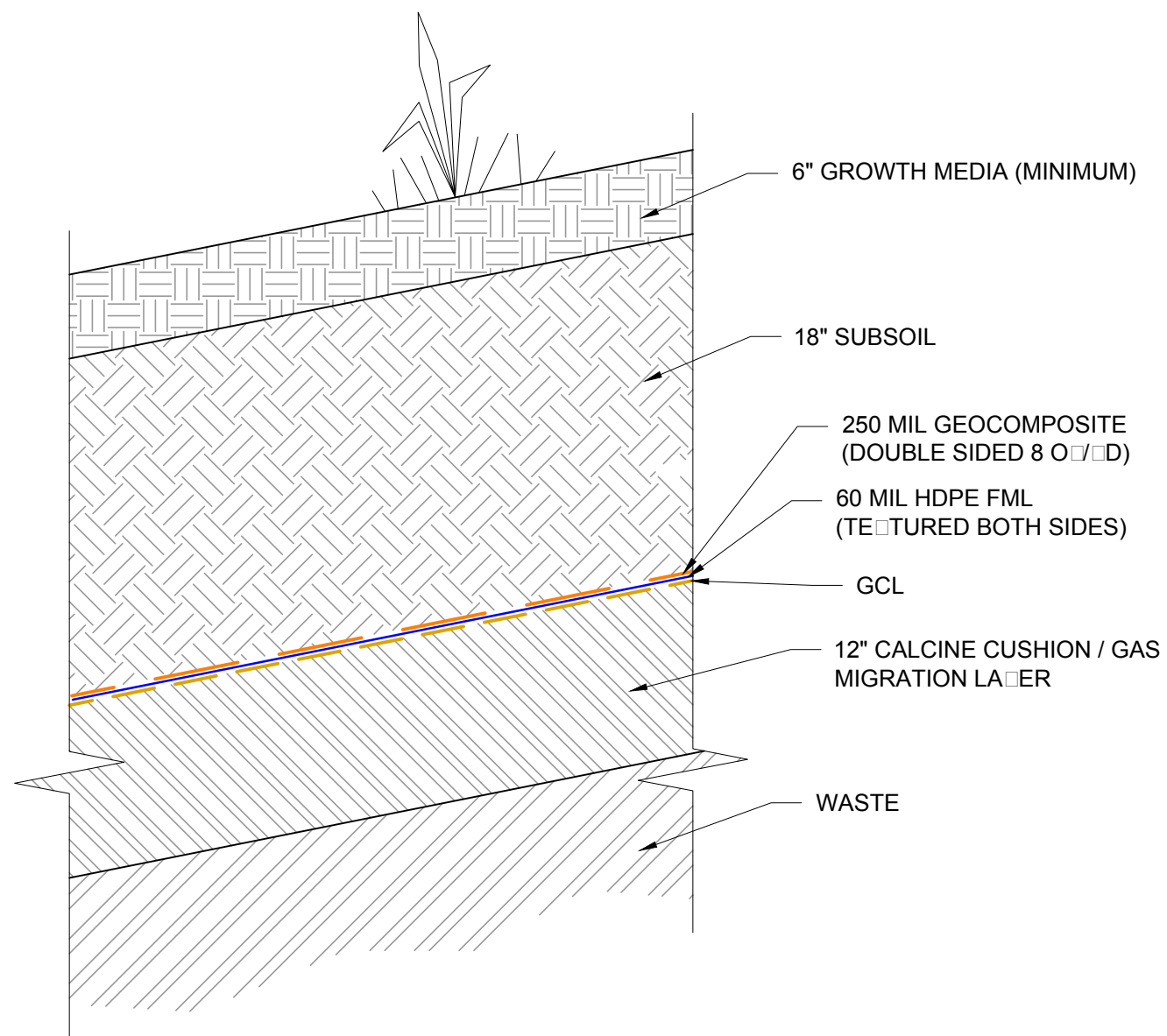
**4 DETAIL**  
COILER SYSTEM ANCHOR TRENCH  
WITHOUT TOE DRAIN  
NTS



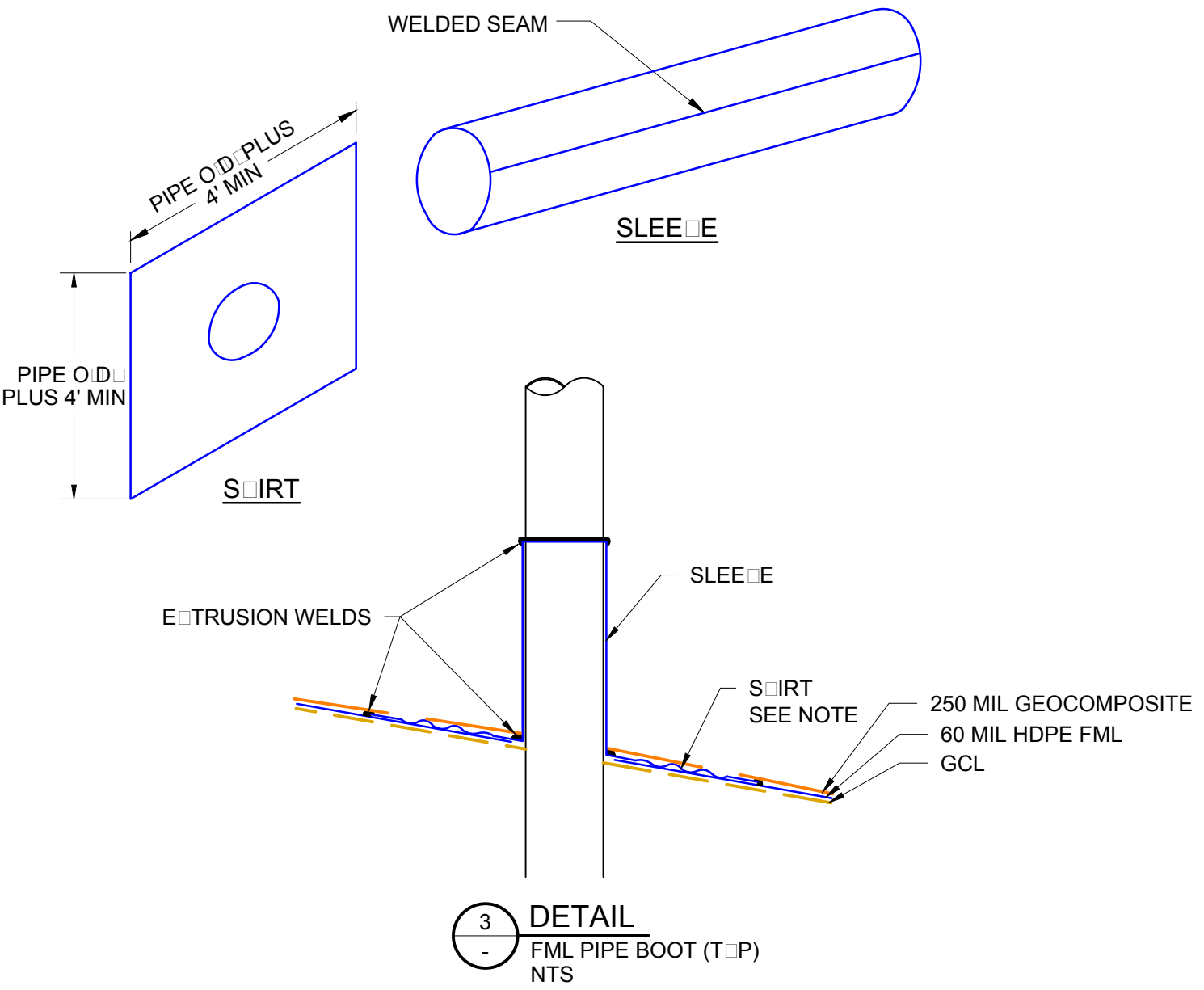
**A SECTION**  
REPOSITORY TYPICAL SECTION  
NTS



**1 DETAIL**  
TYPICAL BOTTOM LINER SYSTEM  
NTS




**2 DETAIL**  
TYPICAL COILER SYSTEM  
NTS



**3 DETAIL**  
FML PIPE BOOT (TIP)  
NTS

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APPROVED BY	GWL 04/26/18
SCALE:	AS NOTED



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Multistate Trust LLC,  
Trustee of the Multistate  
Environmental Response Trust

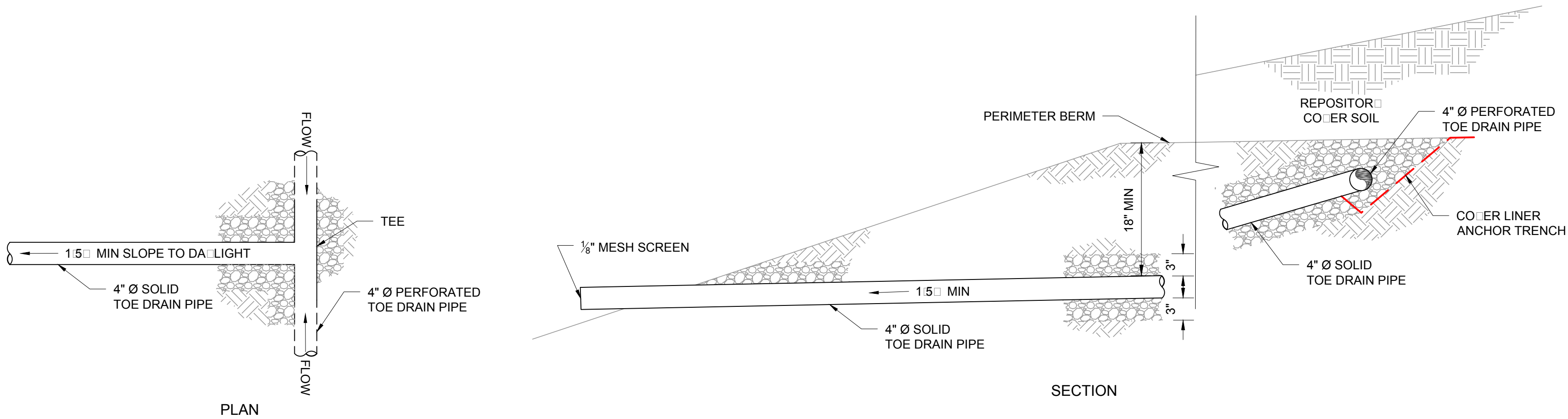
**Hydrometrics, Inc.**  
Consulting Scientists and Engineers  
  
Helena, Montana 59601  
3020 Bozeman Avenue  
(406) 443-4150

10-ACRE POND REMOVAL ACTION AT THE FORMER KERR-MCGEE SODA SPRINGS PLANT	
REPOSITORY DETAILS	

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SHEET NUMBER 10	REV 

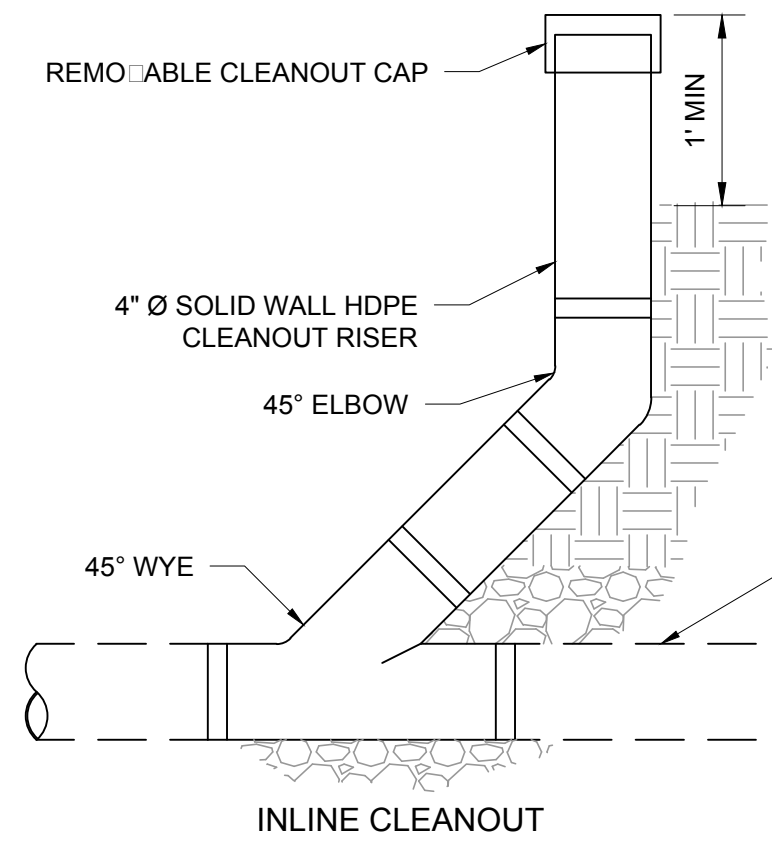




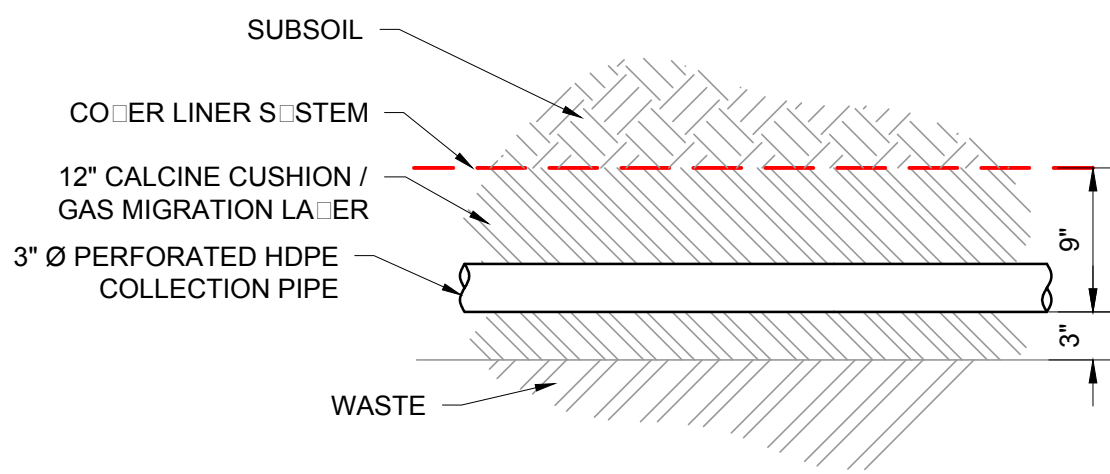
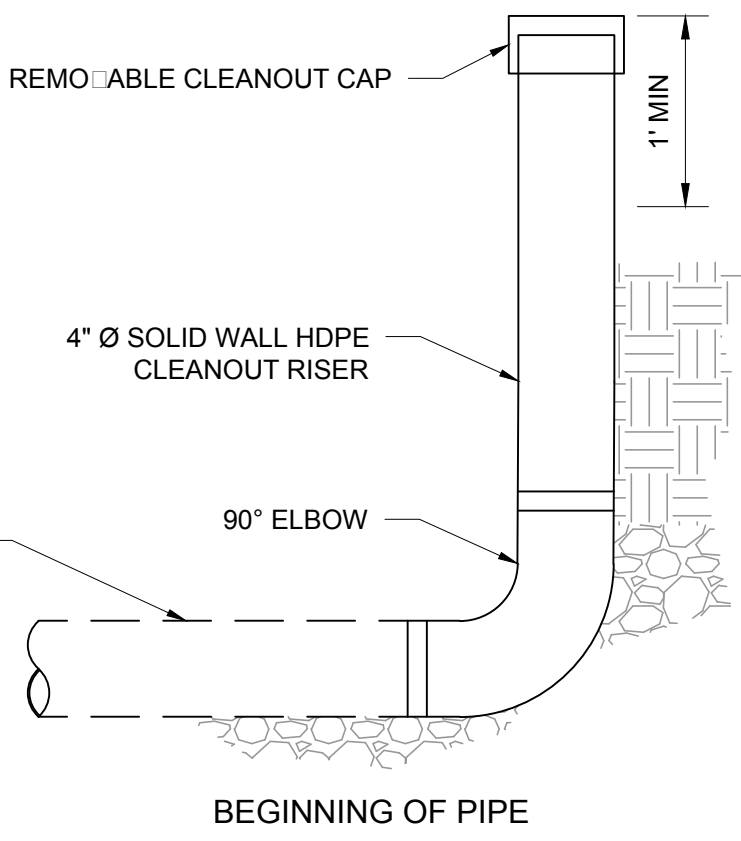


1 DETAIL  
TOE DRAIN TERMINATION  
NTS

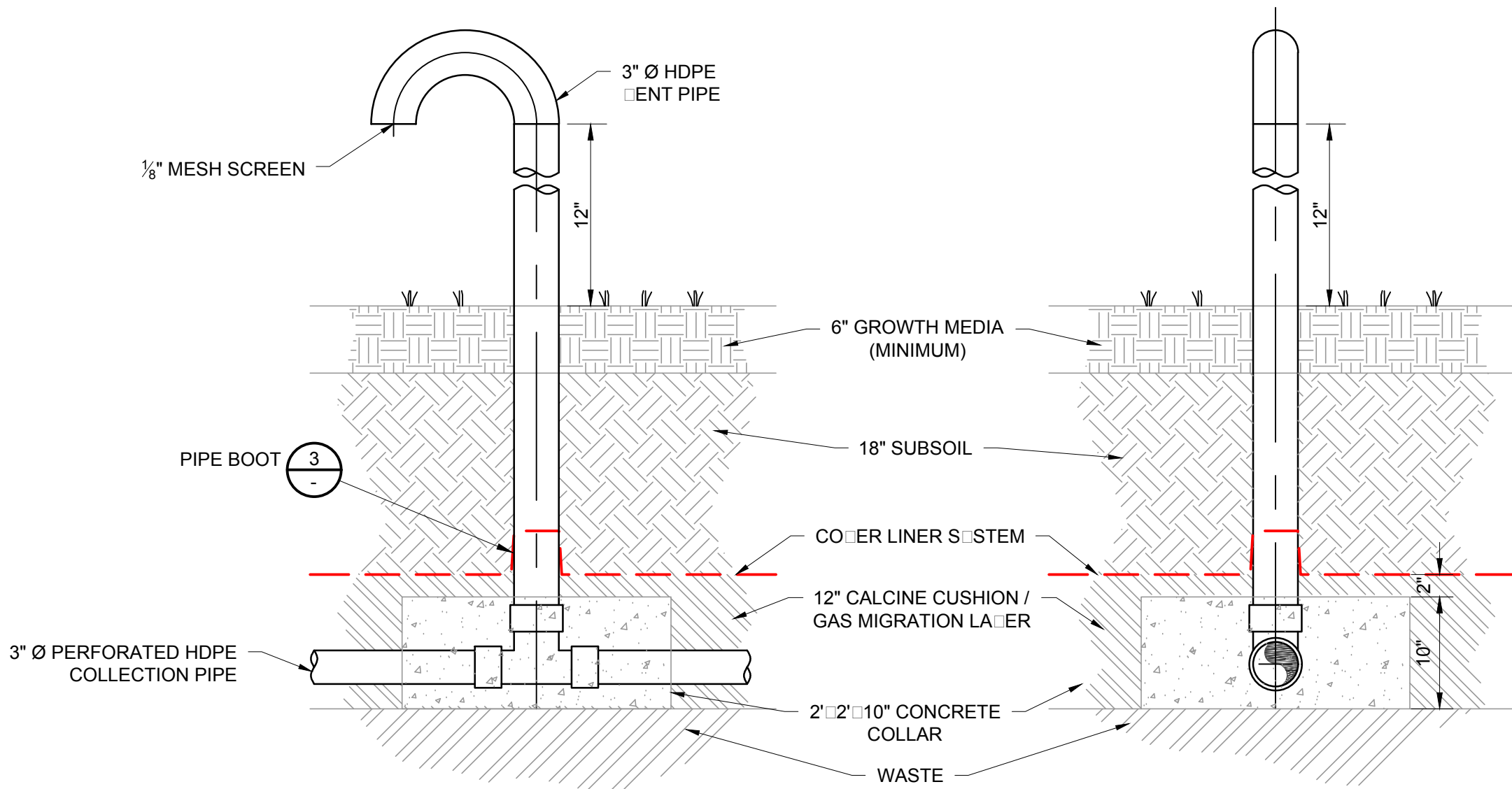
- NOTES:
1. SLOPE SOLID DRAIN PIPE AS REQUIRED TO PROVIDE MINIMUM 18" COVER UNDER PERIMETER BERM.
  2. INSTALL PERFORATED TOE DRAIN PIPE IN COFFER LINER SYSTEM ANCHOR TRENCH, AS SHOWN ON SHEET 10.
  3. EMBED SOLID DRAIN PIPE IN DRAIN GRAVEL WITH 3" BEDDING, 3" COVER, AND A MINIMUM TRENCH WIDTH OF 1'.
  4. ENSURE OUTFALL LOCATION IS STABLE. IF NECESSARY, INSTALL ROCK SPLASH PAD OR OTHER APPROVED PERMANENT BMP FOR EROSION PROTECTION.



2 DETAIL  
TOE DRAIN CLEANOUT  
NTS



3 DETAIL  
GAS COLLECTION PIPE TRENCH (TIP)  
NTS



4 DETAIL  
GAS VENT PIPE  
NTS

- NOTES:
1. PROVIDE MINIMUM 2" CLEAR COVER AROUND PIPE.
  2. SUBCONTRACTOR MAY USE 4" Ø PIPE IN PLACE OF 3" Ø PIPE.

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APPROVED BY	GWL 04/26/18
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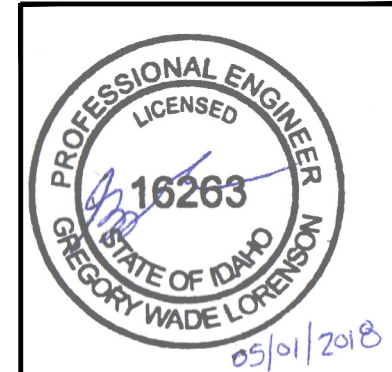
Greenfield Environmental  
Multistate Trust LLC,  
Trustee of the Multistate  
Environmental Response Trust

Hydrometrics, Inc.  
Consulting Scientists and Engineers

Helena, Montana 59601  
3020 Bozeman Avenue  
(406) 443-4150

10-ACRE POND REMOVAL ACTION AT THE FORMER  
KERR-MCGEE SODA SPRINGS PLANT

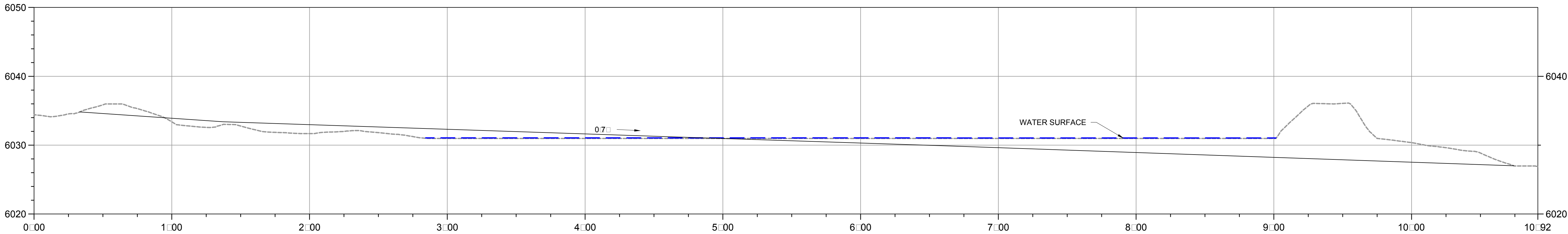
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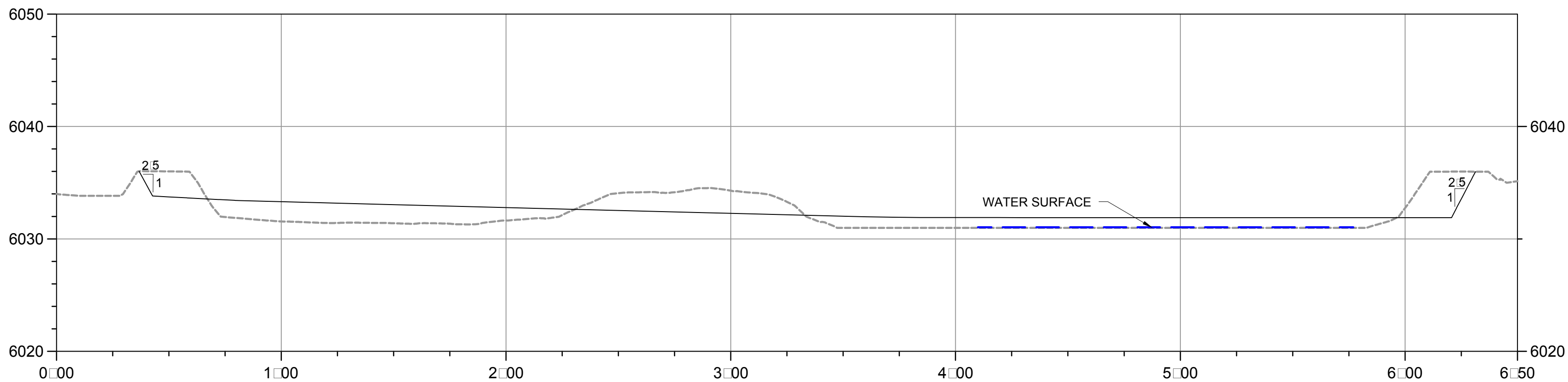
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REV	



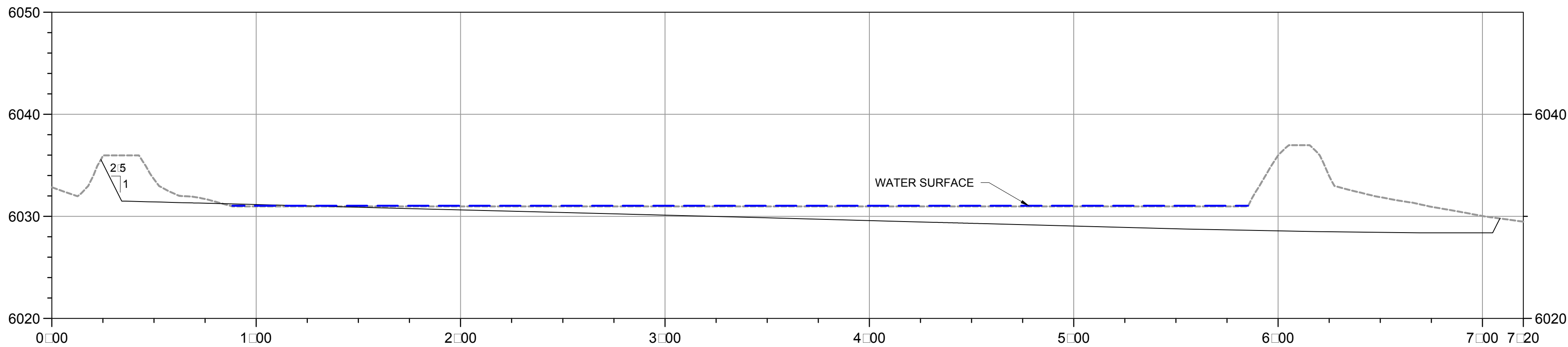




**A** SECTION  
14 10-ACRE POND AREA REGRADING  
1" = 40' (H)  
1" = 8' (V)



**B** SECTION  
14 10-ACRE POND AREA REGRADING  
1" = 40' (H)  
1" = 8' (V)



**C** SECTION  
14 10-ACRE POND AREA REGRADING  
1" = 40' (H)  
1" = 8' (V)

**LEGEND**

- PROPOSED REGRADE
- - - EXISTING GROUND
- - - APPROXIMATE WATER SURFACE AT TIME OF SURVEY (ELEVATION 6031±)

**NOTES:**

- FINAL REGRADING WILL BE BASED ON BEDROCK OUTCROPS AND OTHER SITE CONDITIONS ENCOUNTERED; ADJUST REGRADING AS DIRECTED.
- DRAINAGE SLOPES ALONG GRADING EXTENTS SHALL BE 2.5:1 OR FLATTER.
- TOP OF WATER SHOWN AT TIME OF SURVEY; EXISTING GROUND INCLUDING SLUDGE AND POND LINER IS NOT SHOWN INSIDE EDGE OF WATER FOOTPRINT.

REVISIONS	NO	BY	DATE	DESCRIPTION

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Project No.:		
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APPROVED BY	GWL	04/26/18
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Consulting Scientists and Engineers

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3020 Bozeman Avenue  
(406) 443-4150



10-ACRE POND REMOVAL ACTION AT THE FORMER  
KERR-MCGEE SODA SPRINGS PLANT

**10-ACRE POND AREA  
REGRADING PROFILES**



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1703401H007	
AUTOCAD 2004 DRAWING (DWG)	
SHEET NUMBER	REV
13	△

## **APPENDIX B**

### **TECHNICAL SPECIFICATIONS**

# SECTION III

## SPECIAL PROVISIONS

10-Acre Pond Removal Action  
KERR-MCGEE CHEMICAL CORP. –  
SODA SPRINGS PLANT SUPERFUND SITE  
SODA SPRINGS, CARIBOU COUNTY, IDAHO

Prepared for:

**Greenfield Environmental Multistate Trust, LLC**  
Trustee of the Multistate Environmental Response Trust

May 1, 2018

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## LIST OF DOCUMENT REVISIONS

Revision No.	Author	Version	Description	Date
Rev 0	Hydrometrics	0.1	Draft for Trust and HA Review	3/5/18
Rev 1	Hydrometrics	0.2	Out for Bid	5/1/18
Rev 2				
Rev 3				
Rev 4				

## SECTION III SPECIAL PROVISIONS

### **1. INTRODUCTION**

This section of the Contract Documents describes the Work required as shown on the Drawings. For any discrepancies between the Special Provisions and the Technical Specifications, the Special Provisions will govern. For the purposes of this Project, the terms “Engineer” and “Owner” are synonymous throughout the Contract Documents, Special Provisions, Drawings and Figures, and Technical Specifications and refer specifically to Pioneer Technical Services, Inc. (Pioneer). The term “Multistate Trust” refers specifically to the Greenfield Environmental Multistate Trust, LLC not individually but solely in its representative capacity as Trustee of the “Site”, more particularly described as the Soda Springs Plant Superfund Site Soda Springs, Idaho. The term “Subcontractor” and “Contractor” are synonymous and refer to the construction contractor responsible for performing the Work under this Subcontract. Pioneer will determine the meaning of project-related parties referenced in the Contract Documents if the party is not included in the definitions above, or if any ambiguity exists.

Pioneer will choose the successful Subcontractor in consultation with Hydrometrics, Inc. (Hydrometrics) and the Multistate Trust, and subject to the approval of the United States (U.S.) Environmental Protection Agency (EPA). The EPA may also consult with the Idaho Department of Environmental Quality (IDEQ) on the approval of the Selected Firm. Collectively, the EPA and IDEQ may be referred to in this Bid Solicitation and elsewhere as the “Beneficiaries” since they are the governmental entities that have certain approval rights over the Multistate Trust with respect to the Site.

The selection of the Subcontractor will be based on the criteria described in this Bid Solicitation, the information you provide, and any other factors deemed appropriate. As a private entity, Pioneer is not subject to any governmental, public procurement or external contractor selection requirements. Pioneer reserves the right to negotiate with more than one Subcontractor responding to this Bid Solicitation.

### **2. PROJECT DESCRIPTION**

The Site is located north of and adjacent to the City of Soda Springs, Idaho and comprises approximately 150 acres, of which 50 acres contain structures and facilities proposed for demolition. The Site is located east of State Highway 34, approximately 3 miles north of the intersection with U.S. Highway 30. The Monsanto Chemical Company Soda Springs, Idaho phosphate processing plant is located west of the Site along Highway 34. Crop and rangeland are found on the north, east, and south sides. All Work will be completed on private lands owned by the Multistate Trust and are subject to ongoing corrective actions being conducted under the Resource Conservation and Recovery Act (RCRA).

This Project more particularly involves removal and disposal of liquids and solids from the 10-Acre Pond, construction of a lined on-Site repository, grading and compacting waste delivered to the on-Site repository by the Demolition Contractor, and site regrading and restoration.

### **3. SITE AND OTHER INFORMATION**

The information contained in this Bid Solicitation and any information, documents, reports, maps, data and other materials of any kind or nature provided directly or indirectly by the Multistate Trust in connection with the Site including, without limitation, the Background Documents and Technical Data, are provided solely as references for the convenience of Bidders and Subcontractor. All such information is presented “as is, where is” and “with all faults.” The Multistate Trust does not make, and hereby expressly disclaims, all representations, warranties, covenants or guaranties, express or implied, with respect to such information and materials, including, without limitation, as to the accuracy, completeness, usability, merchantability and fitness for any particular purpose of such information. Bidders are solely responsible for ensuring that the information contained in their Bid is accurate and complete. Reliance on the contents of this Bid Solicitation or any communications with or information provided by the Multistate Trust is at the Bidder’s sole risk. A Bidder’s incorrect assumptions about the Site or the nature or extent of the Work under this Subcontract will not be considered a basis for a revision to the Subcontract, Schedule, or compensation under the Subcontract. Should Bidder believe that there might be a material error or mistake in this Bid Solicitation, the proposed Subcontract or any other information provided by the Multistate Trust, immediately notify Pioneer in writing by e-mail of the matter. The Bidder is solely and fully responsible for the contents of their individual Bid; Pioneer and the Multistate Trust are not liable for any errors or assumptions. Pioneer and Multistate Trust will have no liability or obligation to the Bidder or any other person or entity under or in connection with this Bid Solicitation.

### **4. THE TRONOX BANKRUPTCY AGREEMENTS**

This Subcontract is subject and subordinate in all respects to the terms, conditions, provisions and requirements of the Consent Decree and Environmental Settlement Agreement (see Supplementary Conditions Exhibit D) and the Multistate Trust Agreement (see Supplementary Conditions Exhibit E) (collectively, the “Tronox Bankruptcy Agreements”). By submitting a Bid, Subcontractor acknowledges that it has read and is familiar with the Tronox Bankruptcy Agreements and agrees to perform the Work in accordance with the Tronox Bankruptcy Agreements and the Subcontract Documents.

### **5. PRE-BID CONFERENCE AND INSPECTION OF SITE**

Prospective Bidders shall attend a mandatory pre-bid conference on the date specified in the Invitation for Bids. Prospective Bidders shall be present at the pre-bid conference to be eligible to bid on the Project. In accordance with the Instructions to Bidders and the General Conditions, Subcontractor shall be satisfied as to the construction conditions by personal examination of the Project area of the proposed Work and any other examination and investigation that Subcontractor deems necessary to make as to the nature of the construction and the difficulties potentially associated with the Project. Subcontractor shall promptly report in writing by e-mail

to Pioneer any conflict, error or discrepancy that Subcontractor may discover and shall obtain a written interpretation from Pioneer before bid submittal or proceeding with the Work.

## **6. CONDITIONS TO ENTER THE SITE**

Each representative for the prospective Bidder and its subcontractors planning to visit the Site in connection with this Bid Solicitation, must execute and provide to the Multistate Trust a signed and executed Standard Release, Waiver and Indemnity (RWI) in the form provided in Section 2. Prospective Bidders shall deliver the signed RWI form to a Multistate Trust representative at the Mandatory Pre-Bid Walkthrough and with the Bid. Each individual attendee at the Pre-Bid walkthrough or any subsequent Site visits shall review the RWI form prior to the Pre-Bid Conference and/or Site visit and shall provide a signed copy of the RWI to the Multistate Trust prior to participation in any on-Site activities.

Bidder shall conduct any additional Site visits during normal working hours and shall not disturb any ongoing operations at the Site. Access to the Site may be arranged through Caitlin Walter at telephone number (509) 220-8729. Bidder must comply with all applicable Site safety requirements during Site visits or testing performed by Bidder.

Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

On request, and to the extent the Multistate Trust has control over the Site, and schedule permitting, the Multistate Trust will provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. The Multistate Trust will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on the Multistate Trust's authority regarding the Site.

Bidder shall comply with all applicable laws and regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by the Multistate Trust or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

Bidder shall fill all holes and clean up and restore the Site to its pre-investigation condition upon completion of such explorations, investigations, tests, and studies.

Bidder shall obtain all permits necessary to complete any investigation completed by Bidder. All costs associated with any Site visit or investigation are at the sole expense of the Bidder.

## **7. RIGHT TO SUBMITTED MATERIALS**

All bids, responses, inquiries, reports, charts, displays, schedules, exhibits, graphs, maps, and other materials provided to Pioneer or the Multistate Trust regarding this Bid Solicitation will become the property of the Multistate Trust. The Multistate Trust will have the right to use any ideas or materials provided regardless of whether a bid is selected or rejected.

## 8. PROJECT RELATED CONTACTS

**Multistate Trust Project Manager:** Greenfield Environmental Multistate Trust, LLC  
1928 Eagle Crest Drive  
Draper, UT 84020  
Telephone: (480) 319-3638  
Contact: Lars Peterson, PMP. P.G.

**Mr. Peterson** is responsible for general oversight of the Project and ensuring flow of information between simultaneous operations (SIMOPS) being completed at the Site for the benefit of the Multistate Trust. The Project Manager and Construction Manager will communicate as needed with the Multistate Trust's Coordinator for this Project.

**Construction Manager:** Hydrometrics, Inc.  
3020 Bozeman Ave.,  
Bozeman, MT 59601  
Telephone: (406) 431-1637  
Contact: Mark Rhodes, P.E.

**Mr. Rhodes** is responsible for coordinating this Project's outcomes with the Multistate Trust's expectations and will provide necessary answers to facilitate construction work.

**Site Demolition and 10-Acre Pond Project Manager:** Pioneer Technical Services, Inc.  
201 E. Broadway, Suite C  
Helena, Montana 59601  
Telephone: (406) 457-8252  
Contact: Joel Gerhart, P.E.

**Mr. Gerhart** is responsible for direct interaction with and coordination of the parties constructing or overseeing the Site Demolition and 10-Acre Pond Project and is acting as the Engineer of Record for this Contract. The Engineer of Record includes but is not limited to the traditional Engineers and Owners rights under the Contract, and the responsibilities and status during construction as set forth in the General Conditions and Supplementary Conditions.

## 9. REGULATORY COMPLIANCE AND PERMITS

Permits are not required for the portions of the Work performed on-Site. However, all project work must comply with all substantive requirements of permits that would otherwise apply to the Work. Subcontractor shall comply with all normally applicable permit conditions and stipulations of any permits obtained by Pioneer, Hydrometrics, and the Multistate Trust. Failure to comply with these Plan(s) and permit(s) is grounds for immediate termination of this Subcontract.

Subcontractor shall obtain all other permits required for the Work prior to starting construction and shall comply with the provisions of any potentially applicable permits already obtained by Pioneer, Hydrometrics and the Multistate Trust. The cost to secure all other permits is incidental

to the Work, including permit requirements for maintenance, record keeping, and reporting. Submit copies of all permits to Pioneer prior to initiating the Work. Delay by Subcontractor in making any required applications/submittals may delay permitting and will not be grounds for any extension of Contract Time.

## **10. SIMULTANEOUS OPERATIONS (SIMOPS)**

Several SIMOPS will require coordination throughout the Work and Subcontractor is required to manage and coordinate with other SIMOPS that will affect construction activities, access and scheduling. The SIMOPS will be discussed and documented during the pre-bid meeting, the preconstruction conference and daily SIMOPS and toolbox meetings throughout this project. Work being completed at the site by other construction contractors, Multistate Trust, and current tenants relies directly on the scheduled performance of the Work under these Contract Documents. Subcontractor shall coordinate the Work under this Subcontract with the Person in Charge(PIC)/SIMOPS Site Lead defined in the Project HSSE Plan (Pioneer 2018a). (included in work of others as specified herein to ensure that the related work items are successfully coordinated. Subcontractor shall coordinate its Work with the work of others as needed to minimize potential conflicts and meet related project schedules. Subcontractor shall include the related sequencing constraints specified herein as a part of the Progress Schedule. Anticipated activities at the Site during the project include:

- Operating, monitoring and maintenance activities.
- Field data collection.
- Demolition of Site buildings and facility infrastructure.
- Removal of existing lined pond and accompanying contaminated water.
- Construction of an on-Site repository.
- Installation of a containment liner system.
- Excavating, hauling, and placing of waste materials.
- Site remediation and reclamation activities.
- Remedial investigation drilling activities
- Installing a new water line to the Main Office Building.
- Construction Oversight.
- Quality Control/Quality Assurance (QA/QC) testing.

## **11. PROJECT MILESTONES**

Project milestones for all projects have identified. These project milestones are critical, any delays will impact this project and any other projects occurring simultaneously. Any delays caused by the Subcontractor may be grounds for termination of this Contract and/or Subcontractor may be assessed liquidated damages. **Table 11-1** summarizes the Project milestones.

**Table 11-1: Project Milestones**

<b>Milestone</b>	<b>Date Complete:</b>
Demolition Project Mobilization (by others)	May 11, 2018
Road Construction and Improvements (by others)	June 8, 2018
Pond Project Mobilization (this Project)	June 22, 2018
On-Site Repository Subgrade Excavation (by others)	June 20, 2018
On-Site Repository Ready for Material Delivery (this Project)	Ready for Cushion July 29, 2018 Ready for Bulk Haul August 15, 2018
Complete Waste Haul to the on-Site Repository (all projects)	Bulk Haul October 27, 2018 Gas Migration Layer October 24, 2018
On-Site Repository Completion and Cap (this Project)	November 16, 2018
Site Cleanup and Demobilization (all projects)	November 30, 2018

Protect all existing utilities, roadways and infrastructure necessary for the continued use of the site at all times. Subcontractor shall preserve and protect utilities, roadways and infrastructure until they ready for removal or rehabilitation. Coordinate and sequence construction activities as needed to work around existing utilities, roadways and infrastructure.

Subcontractor shall repair any damage to the existing utilities, roadways and infrastructure at no cost to the Multistate Trust or Pioneer. Subcontractor shall coordinate with the Multistate Trust, Hydrometrics, Pioneer, the existing tenants and other constructors working at the Site to sequence and time and removal of existing utilities, roadways and infrastructure as part of the work.

## **12. SAFETY**

Subcontractor is responsible for all necessary safety measures and precautions. All on-Site workers and Subcontractors shall comply with all applicable requirements of the Site-wide Health Safety, Security, and Environment (HSSE) Program Plan (HSSE Program) (Pioneer, 2018a) and the Site Demolition, Remediation and Reclamation, Field Activities, and Construction Oversight Site-Specific Health and Safety Plan (SSHASP) (Pioneer, 2018b). Portions of the Site may contain hazardous materials or substances. Subcontractor and all on-Site personnel, including all subcontractors and their employees under Subcontractor's supervision shall comply with all Occupational Safety and Health Administration (OSHA) Regulations including 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER). Ensure and provide documentation to Pioneer that all on-Site workers have completed the 40-hour HAZWOPER course and are current with the annual eight (8)-hour refresher course.

Prepare and submit to Pioneer the Subcontractor's SSHASP in accordance with the Technical Specifications, in compliance with the Project SSHASP (Pioneer 2018b) and all applicable laws, standards and regulations. Prepare the plan in accordance with the following U.S. Department of Labor OSHA standard practices: Safety and Health Standards 29 CFR 1910 (General Industry),



OSHA 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response, Safety and Health Standards 29 CFR 1926 (Construction Industry), and Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, and National Institute for Occupational Safety and Health).

At a minimum, address the following elements in the Subcontractor's SSHASP: staff organization, responsibilities, and authorities; Site description; hazard analysis for each task or operation; general and site-specific training; personal protection equipment (PPE); medical surveillance; personal and environmental exposure monitoring including air monitoring for on-Site workers; standard operating safety procedures, controls, and work practices; communications; illumination; Site control measures; personal hygiene and decontamination; equipment decontamination; emergency equipment and first aid; emergency response and contingency procedures; and logs, reports, and recordkeeping.

The SSHASP shall include a discussion of training, safety procedures, training certificates, risk assessments, planning procedures, inspection procedures, and other requirements necessary to educate all personnel, employees, subcontractors, suppliers, vendors, and others used on the Project. Pioneer will review the SSHASP and Subcontractor shall incorporate all necessary revisions, enhancements, and additional measures requested by Pioneer.

Pioneer will participate in regular safety meetings and will conduct regular safety checks and audits to verify to the extent feasible that Subcontractor is following all applicable requirements under Subcontractor's SSHASP. Pioneer may at any time stop Work to reassess operations and safety considerations as needed to adapt to changing Site conditions or previously unrecognized hazards. Pioneer will participate with Subcontractor throughout the Project in all safety planning efforts as a partner to enhance the safety of all parties working on the Site.

**Failure to comply with all applicable safety requirements is cause for immediate Work stoppage and/or grounds for termination of the Subcontract.** At a minimum, Subcontractor and all lower-tier subcontractors shall comply with the following general safety requirements at all times:

- Subcontractor's employees and lower-tier subcontractor's employees shall wear hard hats, high-visibility safety vests, safety toe shoes, leather gloves, long-sleeved shirts, and safety glasses with side shields.
- Subcontractor's employees and lower-tier subcontractor's employees shall not operate cell phones while driving.
- Subcontractor's employees and lower-tier subcontractor's employees shall observe a maximum speed limit of 15 mph when driving on the Site.
- Subcontractor's employees and lower-tier subcontractor's employees shall wear safety belts at all times when driving or riding in a vehicle or operating equipment.
- First aid kits and fire extinguishers are required in all field vehicles and equipment.
- No drugs, alcohol, or firearms are allowed on the Site or in employees' vehicles.
- No eating or drinking is allowed in the Work area(s).

## 13. SITE PROTECTION AND COORDINATION

Protect all wells, buildings, fences, utilities, roadways and infrastructure necessary for the continued use of the Site at all times. Subcontractor shall preserve and protect all facilities until they are ready for removal or rehabilitation. Coordinate and sequence construction activities as needed to work around and protect all existing facilities that are not specified for removal or demolition.

Subcontractor shall repair any damage to the existing Site facilities at no cost to the Multistate Trust or Pioneer. Subcontractor shall coordinate with the Multistate Trust, Hydrometrics, Pioneer, the existing tenants and other contractors working at the Site to sequence and time any removal of existing facilities as part of the Work.

## 14. DESCRIPTION OF INDIVIDUAL BID ITEMS

The Work, methods of measurement, and methods of payment for each Bid Item are stated in this section. The Special Provisions, Technical Specifications, and Drawings as a whole apply to the Work. Subcontractor shall complete all Work under the Subcontract in accordance with the Special Provisions, Technical Specifications, and Drawings in their entirety. Subcontractor shall perform all Work described herein.

### **Bid Item 1 Mobilization, Demobilization, Bonding and Insurance**

#### **Work Description:**

The Work includes those actions necessary for transporting and moving personnel, equipment, supplies, and incidentals to and from the project area; obtaining necessary permits; establishing all offices and facilities necessary for Work on the project area; paying premiums on Contract bonds; paying insurance for the Subcontract; submitting and obtaining approval of all submittals specified in the Technical Specifications, Special Provisions, and Drawings; and for other work and operations that must be performed or costs incurred before performing Work for the Project. Mobilization costs for subcontracted work shall be included. Administration, bonding, insurance, and preparation of project-related pre-work submittals and documents shall be included in mobilization. Subcontractor's costs for preparing submittals for specific plans related to specific Bid Items may be included in the cost of each specific Bid Item. This Bid Item applies to all Work as described in these Special Provisions.

Construction Office and Other Facilities: Provide all necessary office, storage, trash, and sanitation facilities for Subcontractor's operations. Locate office facilities at the designated staging areas as shown on the Drawings. Office facilities for weekly construction meetings with Subcontractor, Multistate Trust, and Pioneer are available at the Multistate Trust office. Provide and maintain typical portable sanitation facilities commonly used at job sites.

Multistate Trust will facilitate access to existing electrical distribution lines where feasible. Install all electrical service connections to Subcontractor's office facilities and Work areas as needed and provide and maintain power to the Project throughout the Work.

No littering will be allowed on the project area. Provide and maintain suitable garbage receptacles at the staging area and other locations within the project area as appropriate. Cover and physically secure the garbage receptacles to prevent loss of contents by weather or wildlife. Empty the garbage receptacles as needed and ensure that the garbage is properly disposed of at a licensed landfill facility. Inform employees and lower-tier subcontractors of the locations of the garbage receptacles, instruct them not to litter, and require that all garbage generated on site is disposed of properly.

Set up the facilities, maintain them during construction, and dismantle them at the end of the Project.

*Staging Areas:* Equipment and materials staging areas shall be located in and limited to areas shown on the Drawings. Obtain approval from Pioneer of any additional space needed or modifications to the boundaries of the staging areas before starting Work.

Immediately following completion of construction, leave the staging areas in a neat and clean condition as required in the Technical Specifications. Grade and finish all staging area access roads and parking areas in accordance with the Special Provisions and Technical Specifications.

*Site Security:* Subcontractor is responsible for site security and shall retain security personnel or implement other security measures at Subcontractor's own discretion and expense. Install locks on all gates to prevent public access to the project area during construction stoppages greater than two (2) hours, including night times. No itemized payment will be made for site security under this Contract. Any losses occurring as a result of a security breach are the responsibility of Subcontractor.

Post signage at all entrances to inform passers-by of restricted access, and to direct visitors to check in at the construction office. Provide personnel at the site to monitor all traffic, and accompany or direct visitors and deliveries appropriately.

*Good Housekeeping and Material Handling:* Take all reasonable precautions to prevent pollution of air, soil, and water associated with the construction activities. Suspend the handling and hauling of waste both on-Site and off-Site if winds with sustained readings (average hourly rate) of 15 miles per hour (mph) or more evolve.

Subcontractor is responsible for hazardous material containment and cleanup for all materials including motor oil, hydraulic and transmission fluid, antifreeze, brake fluid, and all other materials and chemicals used in the maintenance of equipment and machinery. Store all fuel, oil, grease, and other such materials in one location within the staging areas. Store all materials in a bermed, plastic-lined (minimum of 30 mil) storage area with a capacity of 110 percent (110%) of the volume of all combined containers. Absorbent material shall be available on site at all times for cleanup of any spills. **Subcontractor shall immediately notify Pioneer of any spill of such materials prior to initiating cleanup.**

Remove from the project area all refuse resulting from use, servicing, or repair of equipment. Remove any non-functioning equipment that will not be repaired on site within five (5) days of

breakdown. Remove and dispose of all trash and debris at a state-licensed solid waste management facility as specified in the Technical Specifications. Only waste specified in Bid Item 6 Waste Placement and Compaction may be disposed of in the on-Site repository.

**Road Protection and Maintenance:** Take all necessary precautions to prevent damage to roads located outside of the project area, including the asphalt access road and parking area from the Site entrance to the Site Office area. Repair any damage caused by Subcontractor's traffic at no additional cost to Pioneer, Multistate Trust or other construction contractors working at the site.

**Materials:** Identify a safe area for delivery and storage of all materials subject to approval by Pioneer. Store and prevent mixture of stockpile materials at the project area (e.g., growth media, subsoil, aggregates, etc.) during the Work. Store miscellaneous materials required for the Work as recommended by the supplier or in accordance with the Special Provisions or applicable Technical Specifications. Replace damaged materials at no additional cost to Pioneer or Multistate Trust.

**Work Included:**

- Mobilize and demobilize to and from the project area with all necessary equipment to complete the Work.
- Provide insurance and bonding for the Subcontract.
- Obtain all required permits and provide copies to Pioneer.
- Prepare and submit all preconstruction submittals to Pioneer for approval.
- Provide and remove temporary offices, storage, and sanitation facilities.
- Provide site security.
- Site winterization and maintenance throughout the winter shutdown period, if needed.
- Dispose of all trash and debris generated by Subcontractor at a state-licensed solid waste management facility.
- Provide all labor, tools, equipment, materials, and incidentals necessary to complete the Work as specified.

**Measurement Bid Item 1**

No measurement for Bid Item 1 Mobilization, Demobilization, Bonding and Insurance will be made.

**Payment Bid Item 1**

Payment for Bid Item 1 Mobilization, Demobilization, Bonding and Insurance will be based on the lump sum price bid as shown on the Bid Form of the Contract Documents. Fifty percent (50%) payment for this Bid Item will be allowed once Subcontractor submits Bond and Insurance Certificates, fully mobilizes to the project area, and obtains approval on all submittals required prior to beginning Work. Full payment for this item will be allowed after Subcontractor completes the Work for the remainder of the Subcontract, completes final cleanup work, and fully demobilizes equipment and materials from the project area. **The Bid price for this item must not exceed ten percent (10%) of the total Bid price.**

## **Bid Item 2 Implement Construction Best Management Practices**

### **Work Description:**

Implement Best Management Practices (BMPs) during all phases of the Project as requested and approved by Pioneer to prevent the pollution of State waters by the Work. Pioneer will provide a site-specific Storm Water Pollution Prevention Plan (SWPPP) in accordance with the EPA's National Discharge Elimination System (NPDES) Construction Storm Water Permit. Comply with applicable conditions and stipulations of the SWPPP.

Implement and maintain BMPs for all temporary access and haul roads, at the toe of fill slopes, around stockpiles, and surface runoff channels located within or adjacent to areas disturbed by construction. Construct temporary run-on/runoff ditches as approved by Pioneer and in accordance with the Technical Specifications and the SWPPP. Implement and maintain additional BMPs at the request of Pioneer. Inspect and maintain BMPs during and/or after all precipitation and snowmelt events. Upon completion of the Work, remove all BMPs, if appropriate, or leave in working condition any BMPs as requested and approved by Pioneer.

### ***BID ITEM 2.1 INSTALL STRAW WATTLES***

Provide, install, clean, and maintain certified weed-free 12-inch diameter straw wattles in accordance with the manufacturers' instructions and the Technical Specifications. Provide American Excelsior Premium Straw Wattles, or equivalent, as approved by Pioneer. Install additional straw wattles or replace damaged areas as requested by Pioneer.

### ***BID ITEM 2.2 INSTALL SILT FENCE***

Provide, install, clean, and maintain silt fence in areas requested by Pioneer. Provide and install filter fence in accordance with the Technical Specifications.

### ***BID ITEM 2.3 INSTALL STORM WATER CONTROL BERMS***

Install and maintain storm water control berms along the perimeter of disturbed areas as requested by Pioneer. Run-on control berms will be located along the uphill perimeter of disturbed areas to prevent storm water runoff from entering Work areas. Runoff control berms will be constructed along the downhill perimeter of disturbed areas to collect and direct storm water runoff. Pioneer will stake the alignment of the berms where needed.

### **Work Included:**

- Submit specifications of straw wattles and silt fence.
- Provide, install, clean, and maintain straw wattles and silt fence where requested by Pioneer.
- Construct and maintain runoff control berms where requested by Pioneer.
- Implement, maintain, and remove BMPs as requested and approved by Pioneer.
- Provide all labor, tools, equipment, materials, and incidentals necessary to complete the Work as specified.

### **Measurement Bid Item 2.1 through Bid Item 2.3**

Measurement for Bid Item 2.1 Install Straw Wattles will be by the actual number of linear feet (to the nearest linear foot) of straw wattles installed and maintained as measured by Pioneer.

Measurement for Bid Item 2.2 Install Silt Fence will be by the actual number of linear feet (to the nearest linear foot) filter fence installed and maintained as measured by Pioneer.

Measurement for Bid Item 2.3 Install Storm Water Control Berms will be by the actual number of linear feet (to the nearest linear foot) of runoff control berms installed and maintained as measured by Pioneer.

### **Payment Bid Item 2.1 through Bid Item 2.3**

Payment for Bid Item 2.1 Install Straw Wattles will be based on the unit price bid per linear foot as shown on the Bid Form.

Payment for Bid Item 2.2 Install Silt Fence will be based on the unit price bid per linear foot as shown on the Bid Form.

Payment for Bid Item 2.3 Install Storm Water Control Berms will be based on the unit price bid per linear foot as shown on the Bid Form.

## **Bid Item 3 Provide Water**

### **Work Description:**

Develop a site-specific Dust Control Plan in accordance with the Technical Specifications and submit the plan to Pioneer for approval prior to beginning Work. Apply water for dust control as required at the excavation areas, stockpiles, haul roads, and other areas as requested by Pioneer and as required by applicable air quality standards. Water may also be required for compaction of embankment and waste materials, cleaning equipment and highway approaches, and watering other areas to control dust as requested by Pioneer.

Obtain water from the on-Site hydrants installed by the Demolition Contractor and shown on the Drawings. The Multistate Trust will pay the City of Soda Springs water bill for the water used for the Work. Ensure the water supply meets all requirements of the Technical Specifications. Water from the 10-Acre Pond may be used **within** the on-Site repository **only** for waste compaction and dust control as described in Bid Item 7 10-Acre Pond Dewatering.

Provide, install, operate and maintain all tanks, pumps, pipes, and filling equipment needed to meet the demands of the Work. Ensure that the water loading areas and any required water supply equipment are prepared and readied for use prior to beginning any Work that may require watering. Install storm water BMPs at the water loading area as requested by Pioneer. Payment for BMPs installed at the water loading area will be made under Bid Item 2 Implement Construction Best Management Practices.

Provide and have available on site at all times during construction one or more fully-functional operated water trucks with a total minimum capacity of 4,000 gallons. The trucks and water delivery systems must be approved by Pioneer prior to any use on Site. Trucks shall be equipped with spray bars capable of spreading water uniformly across the surface to be watered and with spray nozzles capable of watering the tops and sides of stockpiles. Apply water to any area on Site within 30 minutes of any request to do so by Pioneer. Failure to comply with these requirements as specified is cause for immediate work stoppage and/or termination of the Subcontract.

Apply water to subgrades and embankments in quantities and a manner to ensure that the subgrade and embankment are compacted in accordance with these Special Provisions and with the Technical Specifications. Apply water at the locations and in the amounts needed to properly complete the Work.

**Work Included:**

- Provide and have available at all times during construction the required number of fully-functional operated water trucks with a minimum total capacity of 4,000 gallons.
- Provide necessary water supply equipment to obtain water from water loading areas.
- Apply water to haul roads, stockpile areas, excavation areas, road embankments, and other construction areas as requested by Pioneer.
- Maintain records of water withdrawals.
- Provide all labor, tools, equipment, materials, and incidentals necessary to complete the Work as specified.

**Measurement Bid Item 3**

No measurement for Bid Item 3 Provide Water will be made.

**Payment Bid Item 3**

Payment for Bid Item 3 Provide Water will be based on the lump sum amount bid as shown on the Bid Form.

**Bid Item 4 Roads and Staging Areas**

**Work Description:**

Work for this item includes grading, dust control, housekeeping, vehicle decontamination cleanup, signage and other Work as needed to maintain roads and staging areas. Maintain all roads as necessary to facilitate the Work. Repair damage to any road caused by Subcontractor, including rutting, breaking up of asphalt, loss of gravel, loss of shape, damage to culverts, plugging of drainage culverts and ditches, and other damage, or as identified by Pioneer.

Inspect all Site roads and approaches regularly to ensure that vegetation, materials, stockpiles, or other obstructions are not encroaching to an extent that impairs visibility or safety. Remove

obstructions as requested by Pioneer to maintain clear sight paths, provide adequate sight distances, and ensure visibility for all vehicles using the roads, including light duty vehicles. Inspect, clean, and maintain all culverts and bridge crossings throughout the Work. Prevent the release of materials from haul vehicles by using bed liners, covering loads, wetting loads, or other methods as appropriate. Immediately cleanup any materials spilled on roadways.

Provide dust control in accordance with the Technical Specifications for all roads utilized by Subcontractor. Apply water and grade roads as needed to minimize dust levels for health, safety, and convenience.

Install, operate and maintain a decontamination station to prevent migration of weeds onto, within, or off the Site and prevent tracking of waste from the Site onto the public roadways.

Subcontractor shall develop and submit a Traffic Control Plan to Pioneer for approval prior to any Work at the Site. The Demolition Contractor will supply, install, and maintain temporary signage and traffic control devices at the main Site entrance in accordance with the Demolition Contractor's approved Traffic Control Plan. Provide and maintain all other temporary signage and traffic control devices in accordance with the approved Traffic Control Plan. Provide and install mounting posts for all temporary traffic control signs meeting the applicable requirements of the Idaho Department of Transportation and the Technical Specifications. Subcontractor shall stop Work at any time that all required signage is not posted and fully functional.

Subcontractor shall securely set and locate signs and other temporary traffic controls, so they are visible to the public at all times when in use. Dismantle, cover, or turn from view all temporary traffic control signage and other devices on roadways at times when traffic control is not required. Employ sufficiently secure methods to cover or turn signs from view to prevent accidental uncovering or turning into view by wind or weather.

The Work requires internal traffic control to coordinate haul traffic and routes with other entities working on the Site. Coordinate with Pioneer as needed to plan, implement, sequence, maintain, and adjust all traffic controls necessary to ensure safe and efficient operations.

Subcontractor shall operate road cleaning and washing equipment to clean the paved approaches at Highway 34 as often as necessary to ensure that no debris is tracked onto public roads. Provide fully functional, operated industrial wet-type street sweepers to remove debris from the paved internal tracking areas. Ensure that all public roads are maintained free of tracked material at all times during the Work. If Pioneer observes or is otherwise made aware of material tracked onto public roads, Subcontractor shall cease all traffic to and from the public roads until the public roadways are cleaned. Provide all traffic control necessary to sweep public roads (if sweeping is needed). Subcontractor shall specify traffic control necessary for sweeping public roads in the Traffic Control Plan.

Upon completion of the Work, all roads, culverts, ditches, and staging areas shall be left in a finished condition as approved by Pioneer and in accordance with the Technical Specifications. Asphalt surfaces shall be clean. All ditches shall be free of any debris. Finish grading shall consist of crowning and sloping the road surfaces, creating rolling dips, regrading side ditches to



restore positive drainage, and grading and/or compacting as necessary to provide a smooth, durable surface meeting the surface smoothness requirements of the Technical Specifications. Subcontractor shall perform all road maintenance necessary throughout the work to ensure roads are safe and to support effective site operations. Maintain the roads in a condition that is safe and easily usable for all light duty vehicles, drilling equipment, and other uses anticipated during this Project.

**Work Included:**

- Develop and submit a Traffic Control Plan.
- Repair and maintain roads.
- Install and maintain temporary drainage measures as required.
- Provide temporary signage, flaggers, and other traffic control devices as specified in Subcontractor's Traffic Control Plan.
- Provide dust control.
- Install, use, maintain, and remove decontamination station.
- Coordinate with other work at the site as required.
- Provide all labor, tools, equipment, materials, and incidentals necessary to complete the Work as specified.

**Measurement Bid Item 4**

No measurement for Bid Item 4 Roads and Staging Areas will be made.

**Payment Bid Item 4**

Payment for Bid Item 4 Roads and Staging Areas will be based on the lump sum amount bid as shown on the Bid Form.

**Bid Item 5 Construct On-Site Repository**

**Work Description:**

Waste materials and soils generated during the 10-Acre Pond Removal Action and Site Demolition will be disposed of in a new on-Site repository. Construct the on-Site repository as described herein and shown on the Drawings.

The Demolition Contractor will complete bulk excavation of the on-Site repository under a separate Project. Excavation is anticipated to be substantially completed prior to the Notice to Proceed date of this Project. The Demolition Contractor will construct the on-Site repository subgrade and perimeter berm to the lines and grades shown on the Drawings within a vertical tolerance of 0.2 feet. Stripped topsoil and excess excavation will be stockpiled near the on-Site repository at the locations indicated on the Drawings.

Implement dewatering methods within the on-Site repository area as necessary to complete the Work. Groundwater is not expected to be encountered; however, storm water will have to be

managed during construction. Install, maintain, and operate collection trenches, sumps, and pumps as required for excavation dewatering. Maintain on Site sufficient fuel, hoses, pumps, and other miscellaneous equipment to provide uninterrupted pumping if necessary. The cost of dewatering and storm water management is incidental to this Bid Item and no separate payment will be made. Prior to placing waste in the on-Site repository, storm water may be discharged on the ground. Dewater the leachate collection and removal system (LCRS) sump immediately prior to placing cushion material in the on-Site repository. Once waste placement begins, including calcine, storm water within the on-Site repository will be considered leachate.. Maintain the leachate level below elevation 6,023 feet in the leachate sump for the duration of the Work. Recirculate leachate removed from the LCRS within the on-Site repository. If necessary, dispose of excess leachate off-Site in accordance with all applicable permits and laws. Include leachate monitoring, handling, and disposal in the Subcontractor Dewatering Plan. The cost of leachate management is incidental to this Bid Item and no separate payment will be made.

Prepare the on-Site repository subgrade to lines and grades shown on Drawings, excavate the bottom liner anchor trench, and install the bottom liner system and leachate collection and removal system (LCRS). Backfill and compact the bottom liner anchor trench. Fill the on-Site repository as described in the Technical Specifications and Bid Item 6 Waste Placement and Compaction. Install the gas vent system, cover liner system, toe drains, and cover soil.

The bottom liner anchor trench shall be backfilled in maximum 1-foot compacted lifts. Ensure that geosynthetic materials are not damaged during anchor trench backfill. Pioneer will provide the Subcontractor with at least one standard Proctor moisture-density test (ASTM D-698) result for the on-Site repository berm soil. Bottom liner anchor trench backfill shall be compacted to a minimum of 92% of the standard Proctor maximum dry density. Test anchor trench in-place density using a certified nuclear densometer (ASTM D-6938) at a minimum frequency of one test per 750 linear feet per lift, at locations selected by Pioneer. Submit nuclear densometer test results to Pioneer\_within 2 days of testing. The costs for all testing associated with anchor trench backfill are incidental to on-Site repository construction.

#### ***BID ITEM 5.1 SUBGRADE PREPARATION***

Construct the bottom liner subgrade to the lines and grades shown on the Drawings. The subgrade shall meet the requirements of Technical Specifications Section 02440, GEOSYNTHETIC CLAY LINER, Part 3.3. Remove all organic material, debris, construction stakes, soil particles greater than 3 inches, and sharp stones from the subgrade surface. Compact the subgrade to a firm, unyielding surface free of wheel ruts, footprints, or other abrupt grade changes. The subgrade surface must be smooth enough to limit horizontal or vertical bridging of the overlying GCL to less than 1 inch.

Compact bottom liner subgrade to a minimum of 90% of the standard Proctor maximum dry density. Pioneer will provide the Subcontractor with at least one standard Proctor moisture-density test (ASTM D-698) result for the on-Site repository soil. Test subgrade in-place density using a certified nuclear densometer (ASTM D-6938) at a minimum frequency of three tests per acre, at locations selected by Pioneer. Rework and retest failing areas. Submit nuclear

densometer test results within 2 days of testing. The costs for all subgrade testing are incidental to Bid Item 5.1.

At the time of GCL installation, the subgrade must be free of standing water, snow, or ice. Pioneer and the Subcontractor must approve of the subgrade condition each day in writing prior to deploying GCL. Maintain the subgrade to the accepted condition and correct all deficiencies that appear after acceptance of the subgrade.

#### **BID ITEM 5.2 GEOSYNTHETIC CLAY LINER (GCL)**

Meet the requirements of Technical Specifications Section 02440, GEOSYNTHETIC CLAY LINER, except as modified herein. The GCL shall be a needle-punch, reinforced geosynthetic composite consisting of granular sodium bentonite encapsulated between two geotextile layers. Bentonite shall be high-swelling sodium bentonite, first quality product mined and processed specifically for the purpose of manufacturing a GCL. Fabric encapsulation shall not contain broken needles or fragments. The GCL shall be factory-manufactured for the purpose of providing a hydraulic barrier. GCL shall be Cetco Bentomat DN or approved equal.

GCL rolls shall be a minimum of 100 feet long. Rolls shorter than 100 feet may be supplied but may not exceed 5% of the total square footage produced for this project.

The finished GCL product shall meet the MARV requirements specified in Table 2 – GCL Properties.

**Table 2 – GCL Properties**

Parameter	Test Method	Frequency	Test Standard
Bentonite Mass per Unit Area	ASTM D-5993	1 per lot <sup>(1)</sup>	0.75 lb/ft <sup>2</sup> MIN
Bentonite Swell Index (2 grams)	ASTM D-5890		24 ml MIN
Bentonite Fluid Loss, ml	ASTM D-5891		18 ml MAX
Bentonite moisture content	ASTM D-5993		35% MAX <sup>(2)</sup>
Geotextile Density	ASTM D-5261		5.9 oz/yd <sup>2</sup> MIN
Hydraulic Conductivity	ASTM D-5887		5 x 10 <sup>-9</sup> cm/sec MAX
Tensile Strength	ASTM D-6768		45 lb/in MIN
Peel Strength	ASTM D-6496		3.5 lb/in MIN
Shear Strength	ASTM D-6243	1 per lot or 1,000,000 ft <sup>2</sup>	500 psf MIN <sup>(3)</sup>

Notes:

- (1) All material used on the project must be from the sampled lot(s).
- (2) Bentonite moisture content measured after incorporation into GCL.
- (3) Hydrated internal shear strength measured at 200 psf normal stress.

The GCL shall be warranted from the date of installation acceptance on a pro-rata basis against Manufacturer's defects for a period of at least 5 years. Installation shall be warranted against

defects in workmanship for a period of 1 year from the date of installation acceptance. Submit material and installation warranties to Pioneer within 30 calendar days of final acceptance of the GCL installation.

Minimum panel overlap is 6 inches for longitudinal seams and 24 inches for horizontal (butt) seams. Do not install horizontal seams on slopes steeper than 4:1 (H:V). Orient cross-slope seam overlap so that seams are shingled in the direction of the grade. During installation, mark each panel with a logical identification code that can be easily referenced.

Visually inspect all GCL for imperfections, faulty, or suspect areas for possible damage prior to, during, and after installation. All such defective liners shall be marked and repaired. Liners that cannot be repaired shall be removed from the work area and replaced.

Use a temporary, smooth rub sheet when sliding textured FML over the in-place GCL to reduce friction. Alternatively, fan the FML to create an air cushion between the FML and GCL when sliding the FML. Repair or replace any GCL damaged or displaced during FML installation.

Only low ground pressure, rubber tired equipment (e.g. ATV with contact tire pressure less than 7 psi) may be operated directly on the GCL. Equipment operating on the GCL shall not make sharp turns or sudden starts or stops. Equipment may be used for transporting supplies across the GCL but may not be used to transport personnel. Personnel shall wear rubber-soled footwear that does not damage GCL.

### ***BID ITEM 5.3 FLEXIBLE MEMBRANE LINER (FML)***

***Note: Due to extended lead times for 60-mil HDPE, the 60-mil double sided textured HDPE material will be procured by the Owner. Contractor will be responsible for installation of the HDPE material.***

Meet the requirements of Technical Specifications Section 02420, FLEXIBLE GEOMEMBRANE LINER, except as modified herein. All FML installed for this project shall be 60 mil double-sided textured high density polyethylene (HDPE). Submit Manufacturer certifications that the FML product meets the MARV requirements specified in Table 3 – FML Properties, as certified by the Manufacturer.

**Table 3 – FML Properties**

Property	Test Method	Test Frequency	Test Standard
<b>Raw Material (Resin)</b>			
Density (g/cm <sup>3</sup> )	ASTM D-1505	N/A	≥0.932
OIT (minutes)	ASTM D-3895	N/A	100
<b>FML</b>			
Thickness (mils)	ASTM D-5994	Every roll	57
Minimum Average Lowest Individual Reading			54
Asperity Height (mils)	ASTM D-7466	Every 2 rolls	16
Density (g/cm <sup>3</sup> )	ASTM D-1505	200,000 lb	≥0.94
Tear Strength (pounds)	ASTM D-1004	50,000 lb	42
Tensile Strength - each direction	ASTM D-6693 Type IV	20,000 lb	
1. Yield Stress (lb/in)			126
2. Break Stress (lb/in)			90
3. Yield Elongation (%)			12
4. Break Elongation (%)			100
Puncture Resistance (lb)	ASTM D-4833	50,000 lb	90
Stress Crack Resistance <sup>(1)</sup> (hours)	ASTM D-5397	200,000 lb	500
Oxidative Induction Time – Standard OIT (min ave) <sup>(1,2)</sup>	ASTM D-3895	200,000 lb	100
Carbon Black Content <sup>(1)</sup>	ASTM D-4218	20,000 lb	2 – 3%
Carbon Black Dispersion <sup>(1)</sup>	ASTM D-5596	50,000 lb	
<b>Seam Strength</b>			
Peel Strength (hot wedge), lb/in	ASTM D-6392	500 - 1,000 ft	91
Peel Strength (extrusion), lb/in	ASTM D-6392		78
Shear Strength (all), lb/in	ASTM D-6392		120

Notes:

- (1) Engineer confirmation testing is not required for these properties. Confirmation tests may be completed at Engineer's discretion.
- (2) Manufacturer may substitute High Pressure OIT testing (ASTM D-5885) for Standard OIT. Test standard for High Pressure OIT is 400 min.

Rolls of FML shall be labelled with lot and roll numbers matching those certified by the Manufacturer. On delivery of FML to the Site, Pioneer or Hydrometrics shall collect samples for confirmation testing. A sample of an appropriate length for confirmation testing shall be cut from one roll for each lot. One half of the sample will be used by Hydrometrics for confirmation sampling, and the other half will be provided to the Subcontractor for independent testing if desired. Hydrometrics will send the confirmation sample to a third-party laboratory for testing as indicated in Table 3 – FML Properties. Hydrometrics will pay for this confirmation testing. Each lot that fails any confirmation test will be rejected. The Contractor is responsible for costs associated with confirmation testing of replacement material.

The FML shall be warranted from the date of installation acceptance on a pro-rata basis against Manufacturer's defects for a period of at least 10 years. Installation shall be warranted against defects in workmanship for a period of 2 years from the date of installation acceptance.

Anchor FML using edge trenches as shown on the Drawings.

Add the following to Technical Specifications Section 02420, FLEXIBLE GEOMEMBRANE LINER, Part 1.3 Submittals:

- Submit the following to Pioneer at least 7 days prior to beginning FML installation:
  - Installation layout drawings showing proposed panel layout including field seams and details. Pioneer shall approve drawings prior to installing the geomembrane. This approval is for the concept only and actual panel placement will be determined by site conditions.
  - Installation Subcontractor's geosynthetic Field Installation Quality Assurance Plan.
- Submit the following to Pioneer within 30 calendar days of final acceptance of the FML installation:
  - As-built drawings showing actual geomembrane placement, seams, test locations, and repair locations.
  - QC documentation and field testing results (destructive and non-destructive tests).
  - Material and installation warranties.

Add the following to Technical Specifications Section 02420, FLEXIBLE GEOMEMBRANE LINER, Part 3.4 Seaming:

3.4.2 Heat Seams

- C. Seams shall be generally oriented parallel to slopes.
- D. Orient cross-slope seam overlap so that seams are shingled in the direction of the grade to prevent potential for runoff flow to pond on the seams.
- E. Minimize number of field seams in corners, odd-shaped geometric locations, and outside corners.
- F. Keep butt seams at least 10 feet horizontally away from toe of slope.
- G. Use a sequential seam numbering system compatible with panel numbering system.
- H. Provide a qualified seaming supervisor who shall provide direct supervision over other welders as necessary.
- I. Welding equipment shall be equipped with gauges showing temperatures in apparatus. Fusion welder shall also display the apparatus speed.
- J. Seaming shall not proceed when adverse weather conditions jeopardize the integrity of the liner installation. Demonstrate that acceptable seaming can be performed by completing acceptable trial welds. Seaming shall not take place when the ambient air temperature is below 35°F or above 100°F except with approval of Pioneer.
- K. Do not begin seaming on liner until all trial seam test samples made by the equipment to be used passes tests as defined below.
- L. Extend seaming to the outside edge of panels to be placed in the anchor trench.
- M. If seaming operations are carried out at night, provide adequate illumination.
- N. Visually inspect all seams. Mark suspect or defective areas and repair prior to covering FML.

- 3.4.3 Hot Wedge Welding
- A. Welding apparatus shall be a double track, self-propelled device equipped with an electronic controller which displays applicable temperatures.
  - B. Clean seam area of dust, mud, moisture, and debris immediately ahead of welder.
  - C. Protect against moisture build-up between sheets.
- 3.4.4 Extrusion Welding
- A. Extrusion welds shall be used for detail seaming around repairs and penetrations.
  - B. Hot-air tack adjacent pieces together using procedures that do not damage the FML.
  - C. Clean and smooth FML surfaces by disc grinder or equivalent.
  - D. Extrudate rod or bead shall be made from the same type resin as the FML. Additives shall be thoroughly dispersed and material shall be free of contamination by moisture or foreign matter.
  - E. Purge welding apparatus of heat-degraded extrudate before welding.
- 3.4.5 Trial Welds
- A. Perform trial welds on FML samples to verify adequate seaming methods and conditions.
  - B. Perform one trial weld for each welding apparatus and operator at the start of each seaming period daily and once every five hours thereafter. Perform additional trial welds whenever changes in climatic conditions could affect seam quality.
  - C. Make trial welds under the same surface and environmental conditions as the production welds (i.e., in contact with subgrade and similar ambient temperature). Trial weld shall be at least 2 feet long and shall be made by joining pieces of geomembrane at least 8 inches wide each. Obtain four 1-inch wide test specimens from the trial weld.
  - D. Quantitatively test specimens for peel adhesion and then for shear strength using a field extensometer provided by the Installation Subcontractor. Test the inside and outside tracks for double-track seams. Allow Pioneer and Hydrometrics to observe testing.
  - E. Trial weld specimens shall pass when the results shown in Table 3 – FML Properties are achieved for both peel and shear test. The break, when peel testing, must be a ductile film tear bond, occurring in the liner material itself and not through peel separation.
  - F. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear. If any of the repeat trial weld samples fail, the welding machine shall not be accepted for seaming until the deficiencies have been corrected and a passing trial weld achieved.
  - G. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.
- 3.4.6 Non-Destructive Testing
- A. Non-destructively test the full length of all field seams by one of the methods described below.

- B. Vacuum Testing. Vacuum box tests shall be performed on all extrusion welds. The vacuum box equipment and test procedure shall conform to this specification and shall be performed in accordance with ASTM D-5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber. Apply soapy water solution to the seam area to be tested. The vacuum box, equipped with a transparent viewing window, shall be centered over the seam area and a vacuum of 3 pounds per square inch shall be drawn. The seam area shall be visually monitored for any soap bubbles for 15 seconds. Seam testing shall continue by overlapping a minimum of 3 inches between each test interval. All defects shall be marked for repair.
- C. Air Pressure Testing. Air pressure tests shall be performed on all double-wedge fusion seams. The air pressure test equipment and procedures shall conform to this specification and shall be performed in accordance with ASTM D 5820, Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes. Seal both ends of the seam to be tested. Insert the pressure needle into the seam's air channel. Pressurize the air channel through the needle between 25 and 30 pounds per square inch (psi). Monitor any pressure drops for 5 minutes. A loss of pressure in excess of 4 psi or a continuous loss of pressure is an indication of a leak. Terminate the test by relieving the pressure from the opposing end of the seam. The pressure shall immediately drop to zero upon opening the opposing end of the seam. If this does not occur, the seam channel shall be checked for obstructions and retested. All defects shall be marked for repair. Air pressure test holes shall be repaired by extrusion welding.
- D. Spark Testing. Spark testing shall be completed in accordance with ASTM D 6365 in areas where both air pressure testing and vacuum testing is not possible. Spark test equipment shall include a hand held holiday spark tester and conductive wand that generates a high voltage. Place an electrically conductive tape or wire beneath the seam prior to welding. Complete a calibration check on a trial seam containing a non-welded segment ensuring the test identifies the defect. Test completed seams by enabling the spark tester and moving slowly over the length of the seam at a distance of 1 inch. A spark indicates a hole in the seam that must be repaired.

#### 3.4.7 Destructive Testing

- A. Destructive test samples shall be analyzed at an initial frequency of one test per 500 linear feet of seam for each seam type. After 10 consecutive passing tests are obtained, the destructive test frequency may be reduced to one test per 1,000 linear feet. Pioneer or Hydrometrics shall determine destructive test locations.
- B. A minimum of one extrusion weld destructive test will be completed.
- C. Cut samples for destructive tests and repair the sample area. Destructive test samples shall be a minimum of 12 inches wide by 36 inches long. Cut the sample into 12-inch lengths. Retain one portion for field testing. Give two portions to Hydrometrics for laboratory testing and archiving.
- D. Cut the field test portion into 1-inch specimens and test using a field extensometer. Test a minimum of 5 samples for peel and shear. Test both tracks



for hot wedge seams. Allow Pioneer and Hydrometrics to observe field testing. Field testing is for QC purposes and will not be used for acceptance.

- E. Hydrometrics will send one portion of each sample to a third-party laboratory for QA acceptance testing. Hydrometrics will pay for laboratory testing. The laboratory will cut the sample into 1-inch test specimens. Test requirements are shown in Table 3 – FML Properties. The laboratory sample will pass if 4 out of 5 specimens meet the test requirements and no individual result is less than 80% of the test requirement. The break, when peel testing, must be a ductile film tear bond, occurring in the liner material itself and not through peel separation.
- F. Do not cover the FML with another material until passing destructive laboratory test results are obtained. Hydrometrics will provide test results within 5 business days of obtaining sample.

#### 3.4.8 Failed Destructive Test Procedure

- A. If a seam fails a destructive test, the seam shall be reconstructed between 2 passed test locations. Alternatively, the seaming path may be traced to an intermediate location at least 10 feet minimum from the failed test or where the seam ends. Do this in both directions from the location of the failed test. Destructively test at the new location. If sample passes, then the seam shall be reconstructed or capped between the test sample locations. If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed. The Subcontractor shall pay all costs associated with retesting failed destructive seams.

Add the following to Technical Specifications Section 02420, FLEXIBLE GEOMEMBRANE LINER, Part 3.5 Protection:

- C. Only low ground pressure, rubber tired equipment (e.g. ATV with contact tire pressure less than 7 psi) may be operated directly on the FML. Equipment operating on the FML shall not make sharp turns or sudden starts or stops. Equipment may be used for transporting supplies across the FML but may not be used to transport personnel.
- D. Personnel shall wear rubber-soled footwear that does not damage FML.
- E. Utilize a temporary rub sheet under generators and other potential sources of heat or chemical contamination.
- F. Do not place granular materials on geomembrane when ambient temperature is less than 35° F, unless it can be demonstrated that materials can be placed without damage to the liner.

Replace the portion of Technical Specifications Section 02420, FLEXIBLE GEOMEMBRANE LINER, Part 3.6 Repair and Replacement, with:

- A. Perform FML repair or replacement at Subcontractor's expense.
- B. Examine all seams and non-seam areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.

- C. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.
- D. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.
- E. Agreement upon the appropriate repair method shall be decided between Pioneer and Subcontractor by using one of the following repair methods:
  - i. Patching - Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
  - ii. Abrading and Re-welding - Used to repair short section of a seam
  - iii. Spot Welding - Used to repair pinholes or other minor, localized flaws or where FML thickness has been reduced.
  - iv. Capping - Used to repair long lengths of failed seams.
  - v. Flap Welding - Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap.
  - vi. Remove an unacceptable seam and replace with new material.
- F. The following procedures shall be observed when a repair method is used:
  - i. All FML surfaces shall be clean and dry at the time of repair
  - ii. Surfaces to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
  - iii. Cuts used to remove damaged FML or create patches shall have rounded edges.
  - iv. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.
- G. Number and log each repair.
- H. Non-destructively test each repair.
- I. Individual repairs in excess of 200 linear feet shall require a destructive test at Subcontractor's expense.

Delete the following from Technical Specifications Section 02420, FLEXIBLE GEOMEMBRANE LINER:

- In Part 3.3.C, the sentence, "Expose no more than 500 square yards of flexible geomembrane at any one time."
- Part 3.4.1 Sewn Seams
- Part 3.8 Covering

#### ***BID ITEM 5.4 GEOCOMPOSITE DRAINAGE LAYER***

Meet the requirements of Technical Specifications Section 02430, GEOCOMPOSITE DRAINAGE LAYER, except as modified herein.

The geocomposite drainage layer shall consist of a 250-mil geonet heat laminated on both sides to an 8-ounce nonwoven geotextile. The finished geocomposite product shall meet the requirements specified in Table 4 – Geocomposite Properties. Values are MARV unless noted otherwise.

**Table 4 – Geocomposite Properties**

Property	Test Method	Test Frequency	Test Standard
Geonet			
Core Thickness (mil)	ASTM D-5199	50,000 ft <sup>2</sup>	250
Transmissivity (gal/min/ft)	ASTM D-4716	50,000 ft <sup>2</sup>	14
Specific Gravity	ASTM D-1505	50,000 ft <sup>2</sup>	0.94
Tensile Strength (lb/in)	ASTM D-7179	50,000 ft <sup>2</sup>	50
Geotextile			
Mass per Unit Area (oz/yd <sup>2</sup> )	ASTM D-5261	90,000 ft <sup>2</sup>	8
Grab Tensile Strength (lb)	ASTM D-4632	90,000 ft <sup>2</sup>	220
CBR Puncture Strength (lb)	ASTM D-6241	600,000 ft <sup>2</sup>	500
Permittivity (sec <sup>-1</sup> )	ASTM D-4491	600,000 ft <sup>2</sup>	1.2
Water Flow (gpm/ft <sup>2</sup> )	ASTM D-4491	600,000 ft <sup>2</sup>	90
Apparent Opening Size (U.S. sieve, max)	ASTM D-4751	600,000 ft <sup>2</sup>	80
Geocomoposite			
Ply Adhesion (lb/in)	ASTM D-7005	50,000 ft <sup>2</sup>	1.0
Transmissivity (gpm/ft (m <sup>2</sup> /sec))	ASTM D-4716	600,000 ft <sup>2</sup>	2.0 (4x10 <sup>-4</sup> )

The FML installation shall be accepted by Pioneer prior to installation of geocomposite on top of the FML. Do not operate equipment directly on the geocomposite.

Delete Technical Specifications Section 02430, GEOCOMPOSITE DRAINAGE LAYER, Part 3.8 Covering. Place cover material as specified in Bid Item 6 Waste Placement and Compaction.

***BID ITEM 5.5 LEACHATE COLLECTION AND REMOVAL SYSTEM (LCRS)***

Construct the LCRS to the lines and grades shown on the Drawings. Install the LCRS after installing the bottom liner system in accordance with Bid Item 5 Construct On-Site Repository.

Install the leachate sump riser as shown on the Drawings. Sump riser shall be solid wall HDPE pipe conforming to ASTM D-3350 with minimum cell class values of 345464C. Pipe shall be manufactured to standard dimension ratio (SDR) 17. Bed the riser pipe in drain gravel and secure it in place for subsequent construction activities. The portion of the riser pipe in the LCRS trench shall be perforated as shown on the Drawings.

LCRS drain pipe shall be 4-inch nominal diameter perforated single wall corrugated HDPE conforming to ASTM F-667. Perforations shall conform to American Association of State Highway and Transportation Officials (AASHTO) materials specification M252 or equal. Bed the drain pipe within the LCRS trench using drain gravel as shown on the Drawings. Lay pipe to ensure positive drainage along its entire length. Provide and install gasketed penetrations at sump riser pipe. Provide and install soil tight end caps at the pipe ends.

Drain gravel shall consist of well graded sand and gravel that is subrounded to round, screened and washed free of vegetable matter, clays, and other deleterious substances that could in time change the hydraulic conductivity of the drainage layer. Submit documentation verifying the drain gravel meets the gradation (ASTM D-6913) and Atterberg limits (ASTM D-4318)

specified in Table 5 – Drain Gravel Properties. Place the drain gravel in a single layer, taking care to protect the drain pipe and underlying geosynthetics.

**Table 5 – Drain Gravel Properties**

Sieve Size	Percent Passing <sup>(1)</sup>
3/4"	100
1/2"	89 – 100
3/8"	40 – 70
#4	0 – 15
#8	0 – 5
Atterberg Limits <sup>(2)</sup>	
Liquid Limit	<40
Plasticity Index	<6

(1) Gradation is equivalent to ASTM C-33 coarse aggregate #7.

(2) Atterberg limit testing not applicable to materials with less than 1% passing the #40 sieve.

Install a separation geotextile fabric on top of the drain gravel as shown on the Drawings. Submit Manufacturer certification that separation geotextile meets the requirements specified in Table 6 – Separation Geotextile. Values are MARV unless noted otherwise.

**Table 6 – Separation Geotextile**

Property	Test Method	Test Frequency	Test Standard
Mass per Unit Area (oz/yd <sup>2</sup> )	ASTM D-5261	90,000 ft <sup>2</sup>	5.9
Grab Strength (lb)	ASTM D-4632	90,000 ft <sup>2</sup>	158
Trapezoid Tear Strength (lb)	ASTM D-4533	90,000 ft <sup>2</sup>	55
Apparent Opening Size (U.S. sieve, max)	ASTM D-4751	600,000 ft <sup>2</sup>	70
Permittivity (sec <sup>-1</sup> )	ASTM D-4491		0.02

#### **BID ITEM 5.6 TOE DRAIN**

Construct the toe drain to the lines and grades shown on the Drawings. Toe drain pipe shall be 4-inch nominal diameter single wall corrugated HDPE conforming to ASTM F-667. Pipe shall be perforated or solid depending on location, as shown on the Drawings. Perforations shall conform to AASHTO M252 or equal.

Bed toe drain pipe as shown on the Drawings using drain gravel meeting the properties specified in Table 5 – Drain Gravel Properties. Install cleanouts at the locations shown on the Drawings. Cleanout spacing will not exceed 200 feet. Cleanout riser pipe shall be 4-inch nominal diameter solid wall HDPE pipe conforming to ASTM D-3350 with minimum cell class values of 345464C. Pipe shall be SDR 26 or heavier. Supply all necessary pipe fittings. Compact fill around cleanouts by hand.

Install a mesh screen on the discharge pipe as shown on the Drawings. Mesh screen shall be constructed of stainless steel with 1/8-inch openings unless otherwise approved.

**BID ITEM 5.7 GAS VENT SYSTEM**

Construct the gas vent system as shown on the Drawings. The gas migration layer will consist of a minimum 1 foot thick lift of granular calcine placed directly below the cover liner system. Place and compact gas migration layer to final grade and then excavate trenches for gas collection pipe.

Gas collection pipe shall be 3-inch nominal diameter perforated single wall corrugated HDPE conforming to ASTM F-667, or approved equal. Perforations shall conform to AASHTO M252 or equal. Bottom of gas collection pipe shall be approximately 9 inches below the top of the gas migration layer. Backfill calcine over pipe and compact. Use precautions necessary to protect gas collection pipe from traffic or other surface loads. The finished gas migration layer shall meet the requirements of Bid Item 5.1 Subgrade Preparation.

Gas vent pipe shall be 3-inch nominal diameter solid wall HDPE pipe conforming to ASTM D-3350 with minimum cell class values of 345464C. Pipe shall be SDR 26 or heavier. Install a 180-degree bend and mesh screen on each gas vent pipe as shown on the Drawings. Mesh screen shall be constructed of stainless steel with 1/8-inch openings unless otherwise approved. Supply all necessary pipe fittings.

Construct a concrete collar at each gas vent pipe as shown on the Drawings and in accordance with ISWPC 701 Concrete Formwork, 702 Concrete Reinforcement, and 703 Cast-in-Place Concrete. Concrete shall be Class 3000. Construct a pipe boot at each gas vent pipe as shown on the Drawings. Ensure gas vent pipe remains vertical without excessively stressing the FML.

**BID ITEM 5.8 COVER SUBSOIL**

Cover subsoil will be obtained from excess soil stockpiled by the Demolition Contractor during on-Site repository excavation and other site activities. Additional subsoil may be excavated from the South Borrow Area. The general locations for subsoil borrow sources are shown on the Drawings. Subsoil shall be free of roots, debris, sharp rocks, soil particles exceeding 3 inches, and other deleterious material.

Spread the subsoil layer with low ground pressure (less than 7 psi) equipment. Place the subsoil layer from the bottom of the slope upward. Spread the subsoil layer so that it “rolls” ahead of the equipment and does not slide against and potentially damage the geosynthetics. Do not make tight radius turns on cover soil. If sliding, wrinkling, or bunching of any geosynthetic material is observed, immediately stop placement of the subsoil layer. Pioneer and the Subcontractor will examine any potentially damaged geosynthetics. Subcontractor shall make necessary repairs at no additional cost.

Haul roads may be constructed on the cover liner system for equipment exceeding 7 psi ground pressure. Haul roads will be constructed with a minimum thickness of 3 feet of suitable compacted soil. Pioneer and the Subcontractor must examine the underlying geosynthetics for damage if rutting exceeds 6 inches or at locations of spinning tracks or tires. Subcontractor shall make necessary repairs at no additional cost. Remove haul roads when they are no longer needed. Loosen the top 6 inches of subsoil if it is heavily compacted in the haul road footprint.

Lightly compact the subsoil to produce a uniform, stable surface. This may be accomplished by tracking with tracked equipment, rolling with non-vibratory compaction equipment with a static weight of 1.5 tons or less, or other approved method. The finished subsoil surface shall meet the lines and grades shown on the plans. Demonstrate that the cover subsoil meets the required thickness. The surface shall be tracked or lightly scarified to a depth of at least 1/2-inch to create a non-uniform interface with the cover growth media.

#### ***BID ITEM 5.9 COVER GROWTH MEDIA***

Cover growth media (topsoil) will be obtained from the South Borrow Area as shown on the Drawings. Growth media shall be free of debris, sharp rocks, soil particles or hard lumps exceeding 3 inches, and other deleterious material. Intermittent organic debris is acceptable.

Coordinate excavation of growth media borrow areas with Pioneer to minimize the area disturbed and ensure that only suitable materials are excavated. Excavate, load, haul, and deliver clean borrow material to the repository cover. Minimize the amount of stripped borrow source open at any time to reduce potential erosion. Strip only that portion of the borrow source necessary to supply material scheduled for immediate hauling and/or stockpiling. Reclaim and restore all disturbed areas outside the staked borrow area limits that are disturbed by Subcontractor operations at no additional cost.

Provide adequate access to and within the borrow area. Design and construct all necessary temporary haul roads to access the borrow source and placement areas for the anticipated loads and sizes of equipment used by Subcontractor. Obtain road building materials (if needed) from locations approved by Pioneer to construct temporary haul roads. Subcontractor's cost to construct and reclaim temporary access roads is included in this Bid Item, and no separate payment will be made.

Install and maintain all BMPs as identified in the SWPPP and as requested by Pioneer before stripping topsoil or performing any excavation. Inspect all erosion control measures as required in the SWPPP and repair or replace as necessary or as requested by Pioneer. Implement all required BMPs prior to encountering freezing conditions. Apply water for dust control as requested by Pioneer. Payment for BMPs will be made under Bid Item 2 Implement Construction Best Management Practices. Water for dust control will be paid under Bid Item 3 Provide Water.

Spread growth media with low ground pressure (less than 7 psi) equipment. Place the growth from the bottom of the slope upward. Do not make tight radius turns on cover soil.

Haul roads may be constructed on the cover liner system for equipment exceeding 7 psi ground pressure. Haul roads will be constructed with a minimum thickness of 3 feet of suitable compacted soil. Pioneer and the Subcontractor must examine the underlying geosynthetics for damage if rutting exceeds 6 inches or at locations of spinning tracks or tires. Subcontractor shall make necessary repairs at no additional cost. Remove haul roads when they are no longer needed and ensure subsoil in the haul road footprint meets the requirements of Bid Item 5.8 Cover Subsoil.

The finished growth media surface shall meet the lines and grades shown on the Drawings. Demonstrate that the cover growth media meets the required minimum thickness. Grade growth media in finished areas to a uniform surface with a loose texture suitable for seeding. Rip overcompacted areas to a depth of approximately 6 inches. Remove debris and break up or remove large clods exceeding 6 inches in diameter.

Track the 5:1 on-Site repository side slopes once growth media is placed and graded. Tracking shall be accomplished using a tracked low ground pressure vehicle equipped with grousers sufficient to groove the surface to at least 1/2-inch. The tracking vehicle shall be operated so as to completely cover the slopes with grouser marks. All grouser marks shall run perpendicular to the natural slopes. The tracking vehicle shall be operated alternately between forward and reverse on each pass to eliminate damage from skid turns. Track slopes when the growth media is sufficiently dry to support equipment.

Once the cover growth media is constructed as specified, Pioneer and the Demolition Contractor will inspect the growth media for acceptance within 3 days. If accepted, Pioneer will approve the finished cover growth media in writing, at which time the Demolition Contractor will be responsible for maintenance and seeding of the on-Site repository.

**Work Included:**

- Prepare on-Site repository subgrade.
- Install bottom liner system.
- Install LCRS.
- Install gas vent system.
- Install cover liner system.
- Install toe drain.
- Install cover soils.
- Provide all labor, tools, equipment, materials, and incidentals necessary to complete the Work as specified.

**Measurement Bid Item 5.1 through Bid Item 5.7**

No measurement for Bid Item 5.1 Subgrade Preparation will be made.

Measurement for Bid Item 5.2 Geosynthetic Clay Liner (GCL) will be by the actual number of square yards (to the nearest square yard) of GCL installed as measured by Prime Contractor. Measurement includes the true area of the GCL surface plus designed burial in the anchor trench.

Measurement for Bid Item 5.3 Flexible Membrane Liner (FML) will be by the actual number of square yards (to the nearest square yard) of FML installed as measured by Pioneer. Measurement includes the true area of the FML surface plus designed burial in the anchor trench.

Measurement for Bid Item 5.4 Geocomposite Drainage Layer will be by the actual number of square yards (to the nearest square yard) of geocomposite installed as measured by Pioneer.

Measurement includes the true area of the geocomposite surface plus designed burial in the anchor trench.

No measurement for Bid Item 5.5 Leachate Collection and Removal System (LCRS) will be made.

Measurement for Bid Item 5.6 Toe Drain will be by the actual number of linear feet (to the nearest foot) of toe drain pipe installed as measured by Pioneer. Measurement will include perforated drain pipe, solid drain pipe, and cleanout riser pipe.

No measurement for Bid Item 5.7 Gas Vent System will be made.

Measurement for Bid Item 5.8 Cover Subsoil will be by the actual number of in-place cubic yards (to the nearest cubic yard) of cover subsoil installed as measured by Pioneer.

Measurement for Bid Item 5.9 Cover will be by the actual number of in-place cubic yards (to the nearest cubic yard) of cover growth media installed as measured by Pioneer.

**Payment Bid Item 5**

Payment for Bid Item 5.1 Subgrade Preparation will be based on the lump sum amount bid as shown on the Bid Form.

Payment for Bid Item 5.2 Geosynthetic Clay Liner (GCL) will be based on the unit price bid per square yard as shown on the Bid Form.

Payment for Bid Item 5.3 Flexible Membrane Liner (FML) will be based on the unit price bid per square yard as shown on the Bid Form.

Payment for Bid Item 5.4 Geocomposite Drainage Layer will be based on the unit price bid per square yard as shown on the Bid Form.

Payment for Bid Item 5.5 Leachate Collection and Removal System (LCRS) will be based on the lump sum amount bid as shown on the Bid Form.

Payment for Bid Item 5.6 Toe Drain will be based on the unit price bid per linear foot as shown on the Bid Form.

Payment for Bid Item 5.7 Gas Vent System will be based on the lump sum amount bid as shown on the Bid Form.

Payment for Bid Item 5.8 Cover Subsoil will be based on the unit price bid per cubic yard as shown on the Bid Form.

Payment for Bid Item 5.9 Cover will be based on the unit price bid per cubic yard as shown on the Bid Form.



## **Bid Item 6 Waste Placement and Compaction**

### **Work Description:**

The Work includes disposing of waste materials and soils generated during the 10-Acre Pond Removal Action and Site Demolition in the on-Site repository. Waste will consist of pond solids, geosynthetics, and subgrade soils excavated from the 10-Acre Pond; various demolition debris and soils generated by the Demolition Contractor; calcine removed from the West Calcine Area by the Demolition Contractor; and any other soil or debris as requested by Pioneer.

Waste generated by the Demolition Contractor will be delivered to the on-Site repository by the Demolition Contractor. All waste will be broken or otherwise reduced in size not to exceed a vertical dimension of 2 feet. All material requiring size reduction will be resized at the demolition or source area before being transported to the on-Site repository. Large, flat pieces of debris shall be spaced to ensure soil or smaller debris can be compacted between pieces. Pipe and other debris with significant void space shall be broken to assure voids can be filled with soil or small debris. Large, long pieces (e.g. timbers, small pipe, beams, manufactured metal, etc.) will be placed horizontally in the cell as flat as possible to minimize voids. Long pieces or sharp debris shall not be placed within 5 feet of the bottom or cover liner geosynthetics. Cut or shred waste geosynthetics to a maximum continuous piece size of 100 square feet so they can be placed in the on-Site repository in a maximum lift thickness of 2 feet while minimizing void space. Distribute waste geosynthetics placed in the on-Site repository to allow areas of permeable soil between loads of geosynthetics. Unless otherwise approved by Pioneer, alternate lifts including large debris or geosynthetics with lifts of soil and small debris to promote compaction and minimize voids. ACM debris will not be sized but will be properly containerized and placed in a location designated by Pioneer.

A 3-foot thick cushion layer of calcine will be placed and compacted on the bottom liner prior to operating equipment in the on-Site repository. Calcine will be delivered to the on-Site repository by the Demolition Contractor. Spread the cushion layer with low ground pressure (less than 7 psi) equipment. Place the cushion layer from the bottom of the slope upward. An access ramp may be constructed from the top of the slope downward. Spread the cushion layer so that it “rolls” ahead of the equipment and does not slide against and potentially damage the geosynthetics. Do not make tight radius turns until the full cushion layer thickness is in place. If sliding, wrinkling, or bunching of any geosynthetic material is observed, immediately stop placement of the cushion layer. Pioneer and the Subcontractor will examine any potentially damaged geosynthetics. Subcontractor shall make necessary repairs at no additional cost. Install the cushion layer to full depth over the entire bottom liner footprint before placing other waste in the on-Site repository.

Ensure a minimum cushion layer thickness of 3 feet is maintained for all haul routes, turnouts, staging, and dump areas. Pioneer and the Subcontractor must examine the underlying geosynthetics for damage at locations of spinning tracks or tires. Subcontractor shall make necessary repairs at no additional cost. Waste placement should begin at the edge of the on-Site repository and proceed outward, building a pad onto which dumping will occur. Low ground pressure equipment should push the waste onto the cushion layer until the first lift of waste is

completed on the cushion layer. Do not operate compaction equipment in the on-Site repository until the first waste lift has been placed on top of the cushion layer.

Waste will be placed in lifts not to exceed 2 feet. Wet pond solids shall be placed in maximum 6-inch lifts and mixed with dry soils using a disc or other method approved by Pioneer. Compact waste with a minimum of 8 passes (4 cycles) of appropriate compaction equipment over the entire waste area. This will likely include a padfoot roller for fine grained soil and smaller debris and a smooth drum roller for coarse soils and larger debris. Additional compaction may be necessary to achieve a firm surface onto which subsequent lifts will be placed. Add water as necessary to achieve specified compaction. Water from the 10-Acre Pond may be used within the on-Site repository.

Construct waste lifts to a generally uniform elevation across the on-Site repository footprint. Temporary slopes greater than 4 feet in height shall not exceed a slope of 3:1. Grade waste along the on-Site repository perimeter so that storm water in contact with waste is contained within the on-Site repository.

Proof roll the waste surface using a fully loaded haul truck. Proof rolling shall occur at least once per week in the presence of Pioneer. During the proof roll, the waste surface shall not result in permanent ruts exceeding approximately 6 inches in depth, rolling elastic deflection, or pumping. Excessively wet waste soils shall be dried by discing, mixing with dry soils, or another method approved by Pioneer. Pioneer may require additional proof rolling at any time if inadequate compaction or excessive moisture is suspected.

A minimum of 1 foot of calcine will be placed as the final lift along the top and side slopes of the on-Site repository. The calcine will provide a gas migration layer and cover liner system cushion layer. Meet the subgrade and gas migration layer specifications in Bid Item 5 Construct On-Site Repository.

**Work Included:**

- Accept calcine cushion material from the Demolition Contractor and place and compact cushion layer.
- Accept soil and demolition waste from the Demolition Contractor.
- Spread, moisture condition, and compact waste. Dry waste as needed.
- Periodically proof roll waste.
- Provide all labor, tools, equipment, materials, and incidentals necessary to complete the Work as specified.

**Measurement Bid Item 6**

Measurement for Bid Item 6 Waste Placement and Compaction will be by the actual number of in-place cubic yards (to the nearest cubic yard) of soil and waste placed in the on-Site repository as measured by Pioneer. The volume will be computed by comparing as-built surveys of the bottom liner system and the cover liner system subgrade (top of gas migration layer).

### **Payment Bid Item 6**

Payment for Bid Item 6 Waste Placement and Compaction will be based on the unit price bid per cubic yard as shown on the Bid Form.

### **Bid Item 7 10-Acre Pond Dewatering**

#### **Work Description:**

The Work includes removal and disposal of the liquid from the 10-Acre Pond through a combination of the following methods:

1. Enhanced evaporation in the 10-Acre Pond;
2. Transporting and using the liquid for moisture conditioning during compaction of placed materials in the on-Site Repository;
3. Transporting the liquid to the on-Site Repository and evaporation through tilling and working the surface of waste materials (calcine) placed in the on-Site Repository; and
4. Transporting and disposal of the liquid at an off-Site hazardous waste disposal facility.

To the maximum extent possible, Contractor shall minimize the contributing drainage area within and near the 10-Acre Pond that may cause precipitation recharge to the pond during the liquid removal and disposal period. Contractor shall berm or otherwise isolate all previously dried portions of the pond to minimize the potential contributions of precipitation to the volume of impounded liquid inside the 10-Acre Pond during the liquid removal and disposal period. Dispose of sludge and filtered particles remaining in the pond once evaporation and pumping of the liquid is complete as described in the Technical Specifications and Bid Item 8 10-Acre Pond Waste Disposal.

#### ***BID ITEM 7.1 ON-SITE POND LIQUID EVAPORATION AND DISPOSAL***

Construct one or more sumps within the 10-Acre Pond from which liquid will be pumped. Protect the pond liner system from damage during sump construction and pumping activities to the extent possible. Do not damage or disturb the liner without prior approval from Pioneer. Supply, install, maintain, and remove all necessary equipment, labor, pumps, piping, and incidentals needed to complete this work. This bid item shall cover all costs necessary to promote enhanced evaporation within the 10-Acre Pond and transport and dispose of the remaining liquid to the on-Site Repository.

Enhanced evaporation may include misting, spraying, heating, or other method of accelerating the evaporative process within the footprint of the 10-Acre Pond as approved by Pioneer. No extension to Project milestones shall be granted to accommodate evaporation of the liquid within the 10-Acre Pond.

The remaining liquid in the pond that has not been disposed of via enhanced evaporation, shall be disposed of in the on-Site Repository as either dust suppression, water conditioning for compaction, or through tilling and working the surface of waste materials, as approved by Pioneer. 10-Acre Pond liquid shall not be used for any other purposes on Site.

**Work Included:**

- Construct sump(s) in 10-Acre Pond.
- Remove and dispose of the liquid from 10-Acre Pond.
- Provide means to promote enhanced evaporation of liquid in 10-Acre Pond.
- Transport and dispose of the pond liquid in the new on-Site Repository.
- Provide all labor, tools, equipment, materials, and incidentals necessary to complete the Work as specified.

***BID ITEM 7.2 OFF-SITE POND LIQUID DISPOSAL***

Construct one or more sumps within the 10-Acre Pond from which liquid will be pumped. Protect the pond liner system from damage during sump construction and pumping activities to the extent possible. Do not damage or disturb the liner without prior approval from Pioneer. Supply, install, maintain, and remove all necessary equipment, labor, pumps, piping, and incidentals needed to dewater within the 10-Acre Pond. Transport and dispose of liquid to an off-Site hazardous waste facility. Waste disposal shall be tracked using a Uniform Hazardous Waste Manifest. Submit a copy of each manifest signed by the transporter and disposal facility. Each manifest shall include a disposal ticket from the waste disposal facility. Load, transport, and dispose of the dewatered 10-Acre Pond liquid in accordance with all applicable permits and laws.

**Work Included:**

- Construct sump(s) in 10-Acre Pond.
- Remove and dispose of the liquid from the 10-Acre Pond.
- Transport and dispose of dewatered liquid at an off-Site hazardous waste facility.
- Provide all labor, tools, equipment, materials, and incidentals necessary to complete the Work as specified.

**Measurement Bid Item 7**

Measurement for Bid Item 7 10-Acre Pond Liquid Disposal will be by the actual number of gallons (to the nearest gallon) of liquid removed from the 10-Acre Pond and disposed of within the on-Site Repository or at an approved off-Site disposal facility, as recorded by Pioneer or based on the disposal tickets from the approved waste disposal facility. Pioneer will measure the volume of liquid in the 10-Acre Pond on the date Contractor initiates pond dewatering to establish the Starting Pond Liquid Volume. The Total Liquid Disposal Volume will be calculated based on the Starting Pond Liquid Volume with corrections for precipitation into the ponded Area during the Work.

Pioneer will establish and maintain a precipitation gauge at the 10-Acre Pond and will maintain records of precipitation events during the liquid removal and disposal period for the purposes of adjusting the Total Liquid Disposal Volume. The Ponded Area will be adjusted downward in the calculations as portions of the pond are isolated from contributing to the pond volume during construction as required above.

The Bid Item 7-1 On-Site Liquid Disposal Volume will be calculated by subtracting the Bid Item 7-2 Off-Site Liquid Disposal Volume from the Total Liquid Disposal Volume. The Bid Item 7-2 Water Disposal Volume will be based on the delivery tickets and waste manifest records from the off-Site waste disposal facility.

### **Payment Bid Item 7**

Payment for Bid Item 7-1 On-Site Pond Liquid Evaporation and Disposal for 10-Acre Pond Dewatering will be based on the unit price bid per gallon as shown on the Bid Form.

Payment for Bid Item 7-2 Off-Site Pond Liquid Disposal for 10-Acre Pond Dewatering will be based on the unit price bid per gallon as shown on the Bid Form.

Payment for Bid Item 7 Bonus: Contractor will be paid a bonus equal to 25% of the Total Cost Savings for disposal of the liquid on-Site under Bid Item 7-1 when subtracted from the potential cost for disposal of the liquid at the off-Site disposal facility under Bid Item 7-2. Bonus shall be paid in accordance with the following on-Site Liquid Disposal Bonus Calculation:

Bid Item 7 Bonus Payment	=	$0.25 \times [(\text{Total Liquid Disposal Volume} * \text{Bid Item 7-2 Unit Cost}) - \text{Total Bid Item 7 Payment}]$
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## **Bid Item 8 10-Acre Pond Waste Disposal**

### **Work Description:**

The Work includes removing waste from the 10-Acre Pond and hauling to the on-Site repository. Waste includes pond solids on top of the existing liner, the existing liner geosynthetics, and the existing liner subgrade soil. Dewater as specified, excavate, and haul waste to the on-Site repository.

Pond solids must be dewatered sufficiently to allow transport in haul trucks without spillage of wet soils. Wet pond solids may need to be segregated and stockpiled or windrowed for drying. Trucks loaded with excessively wet solids, including any loads exhibiting free liquid, may not haul to the on-Site repository. Pioneer will make the final decision as to whether soils are too wet to haul. Spilled pond material shall be cleaned up immediately.

Haul all materials in accordance with the Technical Specifications, these Special Provisions, and the approved Transportation Plan. Coordinate hauling on the approved haul routes shown in the approved Transportation Plan with other Site activities as required. Provide all necessary traffic control during all haul operations in accordance with Bid Item 4 Roads and Staging Areas. Excavate per Technical Specifications Section 02210, EARTHWORK, and the approved Excavation Plan.

Excavate pond solids using methods that will protect the existing 10-Acre Pond liner from damage to the extent practicable. Utilize HDPE booms or similar attachments on the blades

excavating equipment. Low ground pressure (less than 7 psi) equipment may be operated directly on the existing 10-Acre Pond liner in areas with no free liquid. Do not make sharp turns or sudden starts or stops while operating on the liner. The Subcontractor is responsible for the cleanup of any liquids released as a result of liner damage caused by the Subcontractor.

Once all solids and liquids are removed from the existing liner, dispose of the existing liner in the on-Site repository. Obtain approval from Pioneer prior to demolishing liner. Cut or shred geosynthetics to a size that can be hauled to the on-Site repository for compaction in maximum 2-foot lifts with minimal void space. Distribute waste geosynthetics placed in the on-Site repository to allow areas of permeable soil between loads of geosynthetics. Do not place successive lifts of waste geosynthetics on top of one other in the on-Site repository. Disassemble and remove the existing dock. All recyclable material (i.e. metal) shall be recycled off-site. Haul remaining waste to the on-Site repository.

Excavate liner subgrade soil to bedrock or a maximum depth of 1 foot. Haul subgrade soil to the on-Site repository. Pioneer will survey the final excavation surface.

Hydrometrics will complete confirmation soil sampling immediately following subgrade removal. Allow access for soil sampling prior to regrading the 10-Acre Pond footprint (Bid Item 9 10-Acre Pond Regrading). Soil sampling will be completed as soon as practicable and in coordination with the Project schedule.

**Work Included:**

- Dewater pond solids.
- Excavate solids from top of pond liner and haul to on-Site repository.
- Remove existing 10-Acre Pond liner system and haul to on-Site repository.
- Remove miscellaneous 10-Acre Pond debris and recycle or haul to on-Site repository.
- Excavate liner subgrade to a maximum depth of 1 foot and haul to on-Site repository.
- Assist with confirmation soil sampling.
- Provide all labor, tools, equipment, materials, and incidentals necessary to complete the Work as specified.

**Measurement Bid Item 8**

Measurement for Bid Item 8 10-Acre Pond Waste Disposal will be by the actual number of bank cubic yards (to the nearest cubic yard) of waste removed from the 10-Acre Pond area as measured by Pioneer. The volume will be computed by comparing a pre-existing survey to Pioneer's survey of the final excavation surface, minus the liquid volume accounted for in Bid Item 7 10-Acre Pond Dewatering.

**Payment Bid Item 8**

Payment for Bid Item 8 10-Acre Pond Waste Disposal will be based on the unit price bid per cubic yard as shown on the Bid Form.

## **Bid Item 9 10-Acre Pond Regrading**

### **Work Description:**

The Work includes all earthwork necessary to regrade the 10-Acre Pond footprint and adjacent area to the lines and grades shown on the Drawings after removing the material described in Bid Item 8 10-Acre Pond Waste Disposal. Excavate berms and higher ground near the pond footprint; place and compact embankment in low areas; construct run-on diversion structures.

All excavation and embankment shall be in accordance with Technical Specifications Section 02210, EARTHWORK, and the approved Excavation Plan. Haul all materials in accordance with the Technical Specifications, these Special Provisions, and the approved Transportation Plan. Coordinate hauling on the approved haul routes shown in the approved Transportation Plan with other site activities as required. Provide all necessary traffic control during all haul operations in accordance with Bid Item 4 Roads and Staging Areas. Install and maintain BMPs as identified in the SWPPP and in accordance with Bid Item 2 Implement Construction Best Management Practices.

Remove the existing fence around the 10-Acre Pond. Pull posts from ground or cut flush with finished grade. Recycle or dispose of all posts, wire, fabric and other removed fencing material off-site. Excavated concrete from post footings may be disposed of in the on-Site repository. This work is incidental to Bid Item 9 and will not be paid for separately. Leave in place and protect the existing fence along the east boundary of the East Calcine repository.

Clear and grub outside of the 10-Acre Pond berm. Excavate and stockpile suitable growth media material from the regrading area as requested by Pioneer. Excavate soil to the lines and grades shown on the Drawings or as requested by Pioneer. Excavated soil will be used as embankment fill in the regrading area.

Place embankment in maximum 12-inch lifts and compact. For embankment fills less than 2 feet deep, compaction may be achieved by tracking with the excavation equipment. For embankment fills exceeding 2 feet, use appropriate compaction equipment to achieve a firm, unyielding fill. Add moisture as necessary to compact soil. Do not overcompact soil within 12 inches of the finished grade.

Place and spread a minimum 6-inch layer of growth media in the regrading area staked by Pioneer. Growth media shall be free of debris, large organic matter, visible contaminants, soil particles exceeding 3 inches, and other deleterious material. Intermittent organic debris is acceptable. Growth media will be obtained from the South Borrow Area as shown on the Drawings and suitable soil stockpiled during regrading activities.

Coordinate excavation of growth media borrow areas with Pioneer to minimize the area disturbed and ensure that only suitable materials are excavated. Excavate, load, haul, and deliver growth media to the regrading area. Minimize the amount of stripped borrow source open at any time to reduce potential erosion. Strip only that portion of the borrow source necessary to supply

material scheduled for immediate hauling and/or stockpiling. Reclaim and restore all disturbed areas outside the staked borrow area limits that are disturbed by Subcontractor operations at no additional cost.

Provide adequate access to and within the borrow area. Design and construct all necessary temporary haul roads to access the borrow source and placement areas for the anticipated loads and sizes of equipment used by Subcontractor. Obtain road building materials (if needed) from locations approved by Pioneer to construct temporary haul roads. Subcontractor's cost to construct and reclaim temporary access roads is included in this Bid Item, and no separate payment will be made.

Install and maintain all BMPs as identified in the SWPPP and as requested by Pioneer before stripping topsoil or performing any excavation. Inspect all erosion control measures as required in the SWPPP and repair or replace as necessary or as requested by Pioneer. Implement all required BMPs prior to encountering freezing conditions. Apply water for dust control as requested by Pioneer. Payment for BMPs will be made under Bid Item 2 Implement Construction Best Management Practices. Water for dust control will be paid under Bid Item 3 Provide Water.

Demonstrate that the growth media meets the required thickness. Grade growth media in finished areas to a uniform surface with a loose texture suitable for seeding. Rip overcompacted areas to a depth of approximately 6 inches. Remove debris and break up or remove large clods exceeding 6 inches in diameter.

Once the growth media is constructed as specified, Pioneer and the Demolition Contractor will inspect the growth media for acceptance within 3 days. If accepted, Pioneer will approve the regrading area in writing, at which time the Demolition Contractor will be responsible for maintenance and seeding of the regrading area.

Construct storm water drainage features to suit the finished grade as requested by Pioneer. Round and blend the top and bottom of slope transitions to adjacent ground as requested by Pioneer.

Pioneer may modify the final regrading surface as necessary to promote drainage and approximately balance cut and fill in the regrading area. Pioneer will provide the Subcontractor a digital surface of the regrading area. Pioneer will survey the final regraded surface.

**Work Included:**

- Clear and grub as needed.
- Strip and stockpile suitable growth media.
- Excavate the regrading area.
- Place and compact embankment fill.
- Place growth media.
- Install storm water drainage features.



- Provide all labor, tools, equipment, materials, and incidentals necessary to complete the Work as specified.

### **Measurement of Bid Item 9**

Measurement for Bid Item 9 10-Acre Pond Regrading will be by the actual number of cubic yards (to the nearest cubic yard) excavated or placed as embankment. Pioneer will measure and calculate the quantity of material based on pre- and post-regrading surveys. The payment quantity will be the sum of bank cubic yards excavated in the regrading area and in-place cubic yards of embankment.

### **Payment of Bid Item 9**

Payment for Bid Item 9 10-Acre Pond Regrading will be made according to the unit price bid per cubic yard, as shown on the Bid Form.

## **15. CONSTRUCTION TOLERANCES AND TESTING**

**Table 7 – Construction Tolerances**

<b>Construction Component</b>	<b>Horizontal Tolerance (feet)</b>	<b>Elevation Tolerance (feet)</b>
Excavation and Fill Placement	±1.0	±0.1
Vegetative Backfill Placement Depth	N/A	+0.1

Pioneer will perform all construction staking, surveying, and QA/QC testing required under the Subcontract. Subcontractor, at no cost to Pioneer or Multistate Trust, may conduct additional testing. Pioneer will coordinate and assist Subcontractor with development of the CQAP for the Work and will coordinate with Subcontractor throughout the Work to ensure Work is completed in accordance with applicable requirements.

## **16. LIST OF ESTIMATED WORK QUANTITIES**

The quantities listed in Table 8 – Estimated Quantities are intended to assist Subcontractor in preparing the Bid. Cubic yard quantities are in-place quantities and should be adjusted during Bid preparation for swell/shrinkage, losses in transport, and other considerations as needed. Note in the Measurement and Payment provisions of these Special Provisions that some estimated quantities are measured based on an assumed thickness of placed material and no allowance is made for placement of material beyond this required thickness. All quantity estimates provided are based on neat line estimates and the actual quantities required to complete the Work may vary from those listed in the table. All estimated quantities provided on the Bid Form or other Contract Documents are approximate and are to be used only as a basis for estimating the probable cost of the Work and for the purpose of comparing the Bids submitted

for the Work. The actual quantity of Work done under unit price Bid Items may differ from the estimated quantities.

**Table 8 – Estimated Quantities**

<b>Description/Item</b>	<b>Unit</b>	<b>Estimated Quantity</b>
Waste Placement and Compaction	CY	328,000
10-Acre Pond Dewatering	GAL	1,000,000
10-Acre Pond Waste Removal	CY	38,700
On-Site Repository Subsoil	CY	27,000
On-Site Repository Growth Media	CY	9,000
GCL	SY	107,250
60 mil HDPE FML	SY	107,760
250 mil Geocomposite	SY	107,250
Separation Geotextile	SY	1,050
4" Toe Drain Pipe	LF	1,880
4" LCRS Pipe	LF	1,090
18" Sump Riser Pipe	LF	50
3" Gas Vent Pipe	LF	1,700
Cast-in-place Concrete	CY	0.75
Drain Gravel	CY	250

## **17. USE OF EXPLOSIVES**

The use of explosives is prohibited.

## **18. ORDER OF WORK**

The following is the suggested general order of Work. The Drawings provide a more detailed construction-sequencing plan. To comply with permitting and meet site coordination and material delivery requirements, generally follow the sequencing plan shown on the Drawings. This suggested order of Work sequencing plan is a guideline for Subcontractor and may be changed during the development of the construction schedule in coordination with Pioneer and Multistate Trust.

1. Secure permits and provide submittals.
2. Mobilization, bonding, and insurance.
3. Implement construction BMPs.
4. Prepare subgrade and install on-Site repository bottom liner system and LCRS.

5. Accept and place calcine cushion from the Demolition Contractor.
6. Dispose of 10-Acre Pond liquid and dry pond solids.
7. Accept and place waste from Demolition Contractor.
8. Haul pond solids to on-Site repository.
9. Haul pond liner and subgrade soil to on-Site repository.
10. Regrade 10-Acre Pond area (coordinate with confirmation sampling (by Hydrometrics)).
11. Complete waste placement and install on-Site repository cover liner system.
12. Install cover soils.
13. Site cleanup, de-mobilization.
14. Contract closeout.

## **19. SUBMITTALS**

All shop drawings, samples, and other submittals required by the Subcontract shall be submitted in accordance with the General Conditions, Paragraph 6.17, Shop Drawings and Samples. This list in Table 9 – Submittals Summary is not exhaustive and Pioneer may request or the Technical Specifications may require additional submittals not listed below. The cost of preparing all submittals is considered incidental. For all submittals requiring review, submit three (3) copies of the required documents to Pioneer.

At a minimum, the following preconstruction submittals must be received and approved by Pioneer prior to beginning Work:

**Table 9 – Submittals Summary**

<b>Submittal</b>	<b>Submittal Description</b>
Project Schedule	Construction schedule including a Gantt chart showing the anticipated start date and duration of each Bid Item. Submit an updated schedule for each construction progress meeting.
Permits	Submit the permits identified in Paragraph 9, Permits and all other necessary permits immediately upon receipt.
Health and Safety Plan	Prepare and submit a site specific Health and Safety Plan as described in the Technical Specifications, Health and Safety and in accordance with Multistate Trust's Master Site Health and Safety Plan.
Quality Control Plan	Submit a quality control plan as described in the Technical Specifications Quality Control/Quality Assurance and resumes of supervisory personnel as described in the Technical Specifications, Supervision by Subcontractor.
Weed Control Plan	Submit a weed control plan as described in described in the Technical Specifications, Weed Control.
Dust Control Plan	Submit a dust control plan as described in the Technical Specifications, Dust Control.
Traffic Control Plan	Submit a traffic control plan as described in the Technical Specifications, Traffic Control.
Transportation Plan	Submit a transportation plan as described in the Technical Specifications, Traffic Control.
Dewatering Plan	Submit a diversion and dewatering plan as described in the Technical Specifications.
Fill and Embankments	Gradation analysis results and moisture/density characteristics (Standard Proctor) for each material at the frequency noted in the Special Provisions and/or Technical Specifications.
Straw Wattles, Filter Fence	Manufacturer's catalog cuts and material specifications, and Manufacturer's installation manuals.
Aggregate Materials and Bedding Materials	Gradation analysis results and source location.
All Geotextiles	Manufacturer's catalog, a one-square-foot material sample cuts, material specifications, and manufacturer's installation manual.
Waste Manifests	Prepare and Submit all waste manifests for transportation and disposal of selected waste materials to off-Site disposal locations.

## 20. REFERENCES

Pioneer 2018a. Draft Site-Wide Health, Safety, Security, and Environment (HSSE) Program Plan (HSSE Program), Kerr-McGee Chemical Corp. Soda Springs Plant Superfund Site. Pioneer Technical Services, Inc. March 7, 2018. (Included in Technical Data)

Pioneer 2018b. Draft Site Demolition, Remediation and Reclamation, Field Activities, and Construction Oversight Site-Specific Health and Safety Plan (SSHASP), Kerr-McGee Chemical Corp. Soda Springs Plant Superfund Site. March 7, 2018. (Included in Technical Data)

**STANDARD TECHNICAL SPECIFICATIONS FOR**  
**10-Acre Pond Removal Action**  
**At the Former Kerr-McGee Soda Springs Plant**

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SECTION 02410	GEOTEXTILE
SECTION 02420	FLEXIBLE GEOMEMBRANE LINER
SECTION 02430	GEOCOMPOSITE DRAINAGE LAYER
SECTION 02440	GEOSYNTHETIC CLAY LINER

**SECTIONS 02500 – PAVING AND SURFACING**

\*REFER TO ISPWC – DIVISION 800

\*Refer to the IDAHO STANDARDS FOR PUBLIC WORKS CONSTRUCTION, 2015 edition.

SECTIONS 02900 – LANDSCAPING

SECTION 02900      GROWTH MEDIA (COVER SOIL)

**DIVISION 3 – CONCRETE**

\*REFER TO ISPWC – DIVISION 700

\*Refer to the IDAHO STANDARDS FOR PUBLIC WORKS CONSTRUCTION, 2015 edition.

## SECTION 01010

### GENERAL REQUIREMENTS

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section describes general requirements, including coordination and Site access, permits, existing Site utilities, personnel identification, weekly coordination meetings, and fire restrictions, in compliance with the Contract Documents.

##### 1.2 CONTRACT DOCUMENTS

- A. Portions of the Contract Documents are written in the imperative mode. Except where specifically intended otherwise, the subject of all imperative statements is CONTRACTOR. For example, "Furnish..." means "CONTRACTOR shall furnish...", "Provide" means "CONTRACTOR shall provide...", etc.
- B. Contract Documents are defined in Article 1 of the Standard General Conditions of the Construction Contract (General Conditions), Form No. 1910-8 prepared and issued by the Engineer's Joint Contract Documents Committee (EJCDC) as modified by the Agreement Form.
- C. The Contract Documents are intended to provide the basis for completion of the Work to serve the intended purpose of OWNER. The Drawings, Special Provisions, and Technical Specifications establish the performance, quality requirements, location and general arrangement of materials and equipment, and establish the minimum standards for quality of workmanship and appearance. Anything not expressly set forth but which is reasonably implied or necessary for proper performance of the Work is considered incidental.
- D. The various portions of the Contract Documents, of which these specifications are a part, are essential parts of the Agreement, and a requirement occurring in any portion or part is binding as though occurring in all. All portions are intended to be complementary and describe and provide for a complete work as referenced in Article 3 of the General Conditions. Unless specifically noted otherwise, the more specific requirements will govern over the more general, and in the case of discrepancy between portions of the Contract Documents the following hierarchy shall be observed:
  - 1. Addenda, which will govern over;
  - 2. Project Drawings, Special Provisions and Appendices, which will govern over;
  - 3. Standard Modifications and Technical Specification, which will govern over;
  - 4. Other referenced requirements.

##### 1.3 WORK DESCRIPTION

- A. CONTRACTOR shall implement and complete the Work as described in the Contract Documents.
- B. The term "as requested by ENGINEER," does not refer to the means and methods of construction, but instead to ENGINEER's directions or instructions to CONTRACTOR as to the Scope of Work, what the Contract Documents require, and whether the Work satisfies the Contract requirements.
- C. The price for each Bid Item shall cover all Contract Work shown on the Drawings and described in the Special Provisions and Technical Specifications. All costs in connection with the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction equipment, tools, and incidentals; and performing all necessary labor and supervision to fully complete the Work,



shall be included in the unit and lump sum bid prices. No item that is required by the Contract Documents for the proper and successful completion of the Work will be paid for outside or in addition to the prices submitted in the Bid.

- D. The Contract Documents do not necessarily name all incidental items required to complete the Work. Incidentals are Work activities for which there is no additional charge to OWNER. The cost of all such incidentals shall be included in various related Bid Items.

#### 1.4 ESTIMATED QUANTITIES

- A. All estimated quantities stipulated in the Contract Documents are approximate and are to be used only as a basis for estimating the probable cost of the Work and for the purpose of comparing the bids submitted for the Work. Actual quantities may differ from estimated quantities.
- B. The basis of payment for Unit Price Work shall be the actual quantity of unit price items supplied. CONTRACTOR agrees that it will make no claim for damages, anticipated profits, or otherwise on account of any difference between the amount of Work actually performed and materials actually furnished and the estimated amounts herein. The Unit Price of an item of Unit Price Work shall be subject to re-evaluation and upward or downward adjustment only in accordance with Paragraph 11.03 of the General Conditions.
- C. All estimated quantities designated as cubic yards shall be considered "bank cubic yards" unless otherwise specified. Excavated bank cubic yards is the quantity of material removed as measured in its original position.
- D. Lump Sum Bid Items based upon estimated quantities are not subject to adjustment for actual quantities. The lump sum bid price is a fixed price and reflects a reasonable compromise of OWNER's and CONTRACTOR's risk that the actual quantity of services/material supplied may be higher or lower than the estimate.
- E. Payment shall constitute full compensation for all labor, equipment, materials, and incidentals necessary to complete the Work as specified.

#### 1.5 MEASUREMENT AND CALCULATION OF QUANTITY

- A. ENGINEER will perform all pay quantity calculations based on either field measurements completed by ENGINEER or surveys completed by a professional surveyor retained either by ENGINEER or directly by OWNER using the methods described in the Special Provisions.
- B. ENGINEER will provide copies of the survey notes and calculations to CONTRACTOR upon request.
- C. CONTRACTOR shall note any discrepancies between ENGINEER's calculation and CONTRACTOR's calculation within 10 days of CONTRACTOR's receipt of ENGINEER's notes and calculations. Any discrepancies will be worked out to the satisfaction of both parties. If ENGINEER and CONTRACTOR cannot mutually agree, the procedures for resolving disputes shall be in accordance with Article 16 of the General Conditions.

#### 1.6 WORK SEQUENCE

- A. Comply with Paragraphs 2.07 and 6.04 of the General Conditions and Milestones specified in the Contract Documents.
- B. Submit detailed schedules as specified in the Contract Documents and Technical Specifications.
- C. Field-verify dimensions indicated on the Drawings before fabricating or ordering materials. Do not scale the Drawings.
- D. Notify ENGINEER of existing conditions differing from those indicated on the Drawings. Comply with Paragraph 4.03 of the General Conditions and any applicable Supplementary Conditions.

## 1.7 COORDINATION AND ACCESS TO SITE

- A. ENGINEER will provide agency coordination to assist CONTRACTOR in completing the Work with a minimum of interference and inconvenience. Access to private property shall be available during construction only as arranged through OWNER.
- B. If Work will impact access to private property, notify OWNER/ENGINEER at least 5 days in advance and the affected property owner at least 72 hours in advance. The closure, or impact, shall be for no more than 8 hours, unless otherwise coordinated and approved by ENGINEER.

## 1.8 USE OF PREMISES

- A. Confine all equipment, storage of materials, and construction operations to the Site.
- B. Without prior written approval from ENGINEER, overnight camping by CONTRACTOR employees and other Project-related personnel is prohibited on private or public lands within the Site during the Work season.
- C. Only authorized personnel are allowed to be on-Site during construction activities.
- D. Do not unreasonably encumber the Project area or public rights of way with materials and construction equipment. Should CONTRACTOR deem it necessary to work outside of the specified construction areas shown on the Drawings, obtain written approval from ENGINEER.
- E. Store only materials and equipment used for the Project on the Site.

## 1.9 PERMITS

- A. Obtain all required permits for the Work prior to starting construction. All costs necessary to obtain and comply with all applicable permits is incidental to the Work, including permit requirements for maintenance, record keeping, and reporting.
- B. Submit copies of all permits to ENGINEER prior to initiating the Work. Submittal or permitting application errors or omissions may delay permitting and will not be grounds for any extension of Contract Time.

## 1.10 UTILITIES

- A. Verify the existence and location of underground utilities in or near the proposed Work.
- B. Utility locations identified in the Drawings are approximate unless otherwise specified and may not include all utilities present at the Site. Omission of an existing or previously abandoned utility location on the Drawings is not to be considered as its nonexistence. Inclusion of an existing utility location on the Drawings is not to be considered as its definite or exact location.
- C. Locate and protect all utilities. Contact One-Call at 811 or 800-551-8344 at least 7 days prior to start of construction.
- D. Do not remove or alter existing utilities without prior written approval of ENGINEER and utility owner. Repair any damage to utilities caused by CONTRACTOR at no cost to OWNER.
- E. Notify ENGINEER of all buried utilities encountered during the Work and leave discovered utilities exposed until the type, size, and location of the utility is recorded by the utility owner(s).
- F. Coordinate utility outages with utility owner(s) and ENGINEER at least 7 days in advance of expected disruption of service. Outages shall be kept to a minimum and any one outage shall not last more than 2 hours.
- G. Provide copies of all written communications with the utility owner(s) to ENGINEER.

- H. Notify the appropriate utility owner(s) at least 10 days in advance of excavating near any utility within or immediately adjacent to the construction area. Meet and coordinate with the appropriate utility representatives to determine exact locations, crossing requirements, and schedules for Work affecting those utilities. Provide ENGINEER at least 72 hours advance notice of meetings scheduled with utility owner(s).

#### 1.11 PERSONNEL IDENTIFICATION

Submit a complete listing of CONTRACTOR personnel working on the Project to ENGINEER, including job title and identification credential number. Update the listing and notify ENGINEER of any CONTRACTOR personnel changes in advance of new personnel engaging in Work on the Project. If a CONTRACTOR employee resigns or is terminated, notify ENGINEER at the earliest opportunity, but no later than the start of the next workday.

#### 1.12 FIRE RESTRICTIONS

- A. Work may be conducted within or near state or federal managed lands. During the summer months, the area may be under fire restrictions requiring limitations to certain Work practices and require the availability of specific fire tools on-Site. Work shall conform to the appropriate fire restrictions.
- B. Fire season restrictions may be adopted after construction commences. Suspend or shut down the Work as needed to comply with fire restrictions. Comply with all applicable federal, state, and local fire restrictions, if adopted.
- C. Appropriate adjustments to the Contract Time will be made if fire restrictions reduce the daily operation hours. Contract Time adjustments will be based on the number of hours per day missed because of fire restrictions. The total number of additional calendar days will be the total number of hours missed divided by the normal number of scheduled daily working hours (i.e., 8 or 10 hours per day, whichever is appropriate) prior to imposing fire restrictions, rounded up to the nearest day.
- D. Work hours will be limited to the hours available within the normal working hours defined in the Contract Documents.

### **PART 2 PRODUCTS**

NOT USED

### **PART 3 EXECUTION**

NOT USED

## **SECTION 01041**

### **PROJECT COORDINATION**

#### **PART 1 GENERAL**

##### **1.1 DESCRIPTION**

This section specifies the requirements for coordinating and sequencing the Work under the Contract Documents.

##### **1.2 SUBMITTALS**

###### **Construction Schedule**

Prepare and submit detailed schedules of planned work, shop drawings, product submittals, and other items to ENGINEER in accordance with Paragraph 2.05 of the General Conditions at the Preconstruction Conference. Acceptance of schedules by ENGINEER will be in accordance with Paragraph 2.07 of the General Conditions. Revise and submit updated schedules as needed throughout the Work.

###### **Progress Schedule**

Submit proposed adjustments to the schedule per Paragraph 6.04 of the General Conditions.

##### **1.3 COORDINATION**

- A. Comply with Article 7 of the General Conditions. Permit utility companies to repair or replace their lines within the Project limits.
- B. Contact the One-Call system at 811 or 800-551-8344 for utility locations before starting any Work.
- C. Comply with Paragraph 7.02 of the General Conditions.

#### **PART 2 PRODUCTS**

NOT USED

#### **PART 3 EXECUTION**

##### **3.1 PRECONSTRUCTION CONFERENCE**

- A. Within 5 days after the effective date of the Agreement and before CONTRACTOR starts Work at the Project area, a Preconstruction Conference between OWNER, CONTRACTOR, ENGINEER, and others as appropriate, will be held to establish a working understanding among the parties as to the Work, in accordance with Paragraph 2.06 of the General Conditions. The purpose of the conference is to discuss schedules, submittal procedures, applications for payment, Site-specific construction related issues, maintaining required records, and any other matters pertinent to the Work.
- B. Discuss the required submittals and agree on any changes to the Project submittals or specified delivery timeframes.

### 3.2 PROGRESS SCHEDULE AND MEETINGS

- A. CONTRACTOR, OWNER, and ENGINEER will meet at regular intervals (typically weekly or bi-weekly) at a mutually agreed upon meeting time and place.
- B. Prepare an agenda and conduct each weekly coordination meeting. The meeting shall identify decisions required, scheduling, work completed in the last week, milestones accomplished, opportunities, problems, and corrective actions.
- C. Include a discussion of the Work to be done in the 2 weeks following the meeting (two-week look-ahead).
- D. ENGINEER will submit minutes of the meeting within 3 working days following the meeting for review and acceptance by all parties.

## **SECTION 01090**

### **SOURCES FOR REFERENCE PUBLICATIONS**

#### **PART 1 GENERAL**

##### **1.1 DESCRIPTION**

This section lists some of the construction industry organizations, professional and technical associations, societies and institutes, and government agencies issuing, promoting, or enforcing standards used or referenced in the Contract Documents along with the abbreviations commonly used for those references. Also included are general requirements for using the industry standards specified and for applying quality control standards.

##### **1.2 DEFINITIONS**

These specifications use Article 1 - Definitions of the Standard General Conditions of the Construction Contract (General Conditions), Form No. 1910-8 prepared and issued by the Engineer's Joint Contract Documents Committee (EJCDC) as modified by DEQ, for the definition of terms herein. Changes to definitions are by either substitution for the article or in Supplementary Conditions.

##### **1.3 USE OF REFERENCE STANDARDS**

- A. Work specified by reference to a published standard or specification of a government agency, technical association, trade association, professional society or institute, testing agency, or other organization must meet or exceed the minimum quality standards for the material and workmanship in the designated standard or specification.
- B. Where specified, ensure products or workmanship meet the prescriptive or performance requirements in the Contract Documents when it is a more stringent standard than the referenced standard. The Contract Documents should reference only one specification to prevent argument as to which specification is most stringent.
- C. If a specific product or material is not specified for the Project, request clarification of the product requirements from ENGINEER.
- D. For all referenced standards, use the current edition and all published amendments available at the time of the bid advertisement.
- E. If two or more standards are specified, provide the product and workmanship meeting or exceeding the requirements of the most stringent standard.
- F. If a conflict exists between standards, meet the more stringent standard.
- G. Where both a standard and a brand name are specified, ensure the proprietary product names meet or exceed the specified reference standard. The listing of a trade name in the Contract Documents does not warrant that the product meets the referenced standard.
- H. Copies of Standards
  - 1. Copies of applicable referenced standards are not bound in the Contract Documents.
  - 2. If copies of standards are needed for work superintendence and quality control, CONTRACTOR shall obtain a copy or copies directly from the publication sources. Maintain copies at the Site and make them available to CONTRACTOR personnel, Subcontractor, OWNER, and ENGINEER.

#### 1.4 ABBREVIATIONS FOR TRADE ORGANIZATIONS AND GOVERNMENT AGENCIES

The following is a list of construction industry organizations and government agencies commonly referenced in the Contract Documents and the abbreviations used.

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturers' Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ABMA	American Bearing Manufacturers' Association
AGA	American Gas Association
AGC	American Concrete Institute
AGMA	American Gear Manufacturers Association
AHRI	Air Conditioning, Heating and Refrigeration Institute
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALSC	American Lumber Standards Committee, Inc.
AMCA	Air Movement and Control Association
AMS	Agricultural Marketing Service
ANLA	American Nursery and Landscape Association
ANSI	American National Standards Institute
APA	Engineered Wood Association
API	American Petroleum Institute
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASA	American Society of Agronomy
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
ASLA	American Society of Landscape Architects
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials International
AWC	American Wood Council
AWI	Architectural Woodwork Institute
AWPA	American Wood Protection Association
AWPB	American Wood Preservers Bureau
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BLM	Bureau of Land Management

CBMA	Certified Ballast Manufacturers Association
CDA	Copper Development Association Inc.
CLFMI	Chain Link Fence Manufacturers Institute
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers' Association of America, Inc.
CoE	Corps of Engineers
CRSI	Concrete Reinforcing Steel Institute
DEQ	Department of Environmental Quality (Idaho)
EJCDC	Engineer's Joint Contract Documents Committee
EPA	U.S. Environmental Protection Agency
Fed. Spec./FS	Federal Specifications
FGMA	Flat Glass Marketing Association
FHWA	U.S. Federal Highway Administration
FM	Factory Mutual Insurance Company (FM Global)
GA	Gypsum Association
HI	Hydraulic Institute
HMI	Hoist Manufacturers Institute
ICBO	International Conference of Building Officials
ICEA	Insulated Cable Engineers' Association
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society of North America
ISA	Instrument Society of America
IDT	Idaho Transportation Department
ISPCW	Idaho Standards for Public Works Construction
JIC	Joint Industry Conferences of Hydraulic Manufacturers
MIA	Marble Institute of America
Mil. Sp./MS	Military Specification
MMA	Monorail Manufacturers Association
MSHA	Mine Safety and Health Administration
MUTCD	Manual on Uniform Traffic Control Devices
NAAMM	National Association of Architectural Metal Manufacturers
NARA	U.S. National Archives and Records Administration
NBHA	National Builders Hardware Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NHLA	National Hardwood Lumber Association
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NLMA	National Lumber Manufacturers Association



NPDES	National Pollutant Discharge Elimination System
NWMA	National Woodwork Manufacturers' Association
NWRA	National Waste and Recycling Association
OECI	Overhead Electric Crane Institute
OSHA	Occupational Safety and Health Administration
PCI	Precast/Prestressed Concrete Institute
PEI	Porcelain Enamel Institute
PS	Product Standards Section - U.S. Department of Commerce
RLM	RLM Standards Institute, Inc.
RMA	Rubber Manufacturers Association
SAE	Society of Automotive Engineers
SDI	Steel Deck Institute
SDI	Steel Door Institute
SIGMA	Sealed Insulating Glass Manufacturing Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Society for Protective Coatings
SSSA	Soil Science Society of America
SWI	Steel Window Institute
TEMA	Tubular Exchanger Manufacturers' Association
TPI	Turfgrass Producers International
UBC	Uniform Building Code
UFC	Uniform Fire Code
UL	Underwriters Laboratories
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFSW	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCLIB	West Coast Lumber Inspection Bureau
WWPA	Western Wood Products Association

## **PART 2 PRODUCTS**

NOT USED

## **PART 3 EXECUTION**

NOT USED

## **SECTION 01300**

### **SUBMITTAL PROCEDURES**

#### **PART 1 GENERAL**

##### **1.1 DESCRIPTION**

This section specifies the requirements for providing submittals, and the review and approval of those submittals. The list below is not considered to be exhaustive and additional submittals may be requested by ENGINEER.

##### **1.2 CONSTRUCTION SCHEDULES**

- A. Submit to ENGINEER a progress schedule under Paragraphs 2.05, 2.07, and 6.04 of the General Conditions within 5 days after Notice to Proceed.
- B. Submit to ENGINEER adjusted progress schedules under Paragraph 6.04 of the General Conditions.
- C. Submit to ENGINEER value schedules under Paragraphs 2.05, 2.07, and 14.01 of the General Conditions within 5 days after Notice to Proceed.

##### **1.3 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

- A. Submit shop drawings to ENGINEER under Paragraphs 2.05 and 6.17 of the General Conditions. Submit all shop drawings for CONTRACTOR, Subcontractor(s) and supplier(s).
- B. Submit material specifications, installation instructions, and manufacturers' recommendations for all products and materials installed as a portion of the Work.
- C. Submit in writing any substitutions to previously approved items for review by ENGINEER.
- D. Within 15 days after Notice to Proceed, submit a complete list of products proposed for use, providing manufacturer's name, trade name, model or catalog numbers, and manufacturer data.
- E. Submit the number of copies needed by CONTRACTOR, plus 3 copies for ENGINEER use.
- F. Where specified, submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices.
- G. Where specified, submit samples of finishes including colors, textures, and patterns.

##### **1.4 PROJECT ADMINISTRATION SUBMITTALS**

- A. Submit a list of employees, job classifications, and current OSHA 29 CFR 1910.120 certificates for all Site workers, and resumes as required in the Contract Documents. Submit at the Preconstruction Conference.
- B. Maintain payroll records weekly in accordance with the Contract Documents. Submit these records to ENGINEER on a monthly basis.
- C. Project Closeout Documentation. Refer to Supplementary Conditions, Part 1, Paragraph 14.

##### **1.5 PROJECT PLAN SUBMITTALS**

- A. Project Schedule. Submit at the Preconstruction Conference and at regular progress meetings.

- B. Diversion and Dewatering Plan. Submit no later than 10 days prior to starting Work that requires water diversion and/or dewatering.
- C. Health and Safety Plan. Submit no later than 10 days prior to the start of Work.
- D. Environmental Protection Plan. Submit no later than 10 days prior to the start of Work.
- E. Transportation Plan. Submit no later than 10 days prior to the start of Work.
- F. Traffic Control Plan. Submit no later than 10 days prior to the start of Work.
- G. Storm Water Pollution Prevention Plan. Submit no later than 10 days prior to the start of Work.
- H. Wind Erosion/Dust Control Plan. Submit no later than 10 days prior to the start of Work.
- I. Contractor Quality Control Plan. Submit no later than 10 days prior to the start of Work.
- J. Weed Control Plan. Submit no later than 10 days prior to the start of Work.
- K. Blasting Plan and explosives licensing requirements. Submit no later than 10 days prior to starting Work that requires blasting and/or explosives.

#### 1.6 QUALITY ASSURANCE/QUALITY CONTROL SUBMITTALS

- A. Submit construction material certifications prior to installation of the materials as specified.
- B. Submit laboratory sample results. Laboratory testing results for any product or material used for the Work shall not be more than 12 months old.
- C. Submit surveying and progress quantity estimates as described in the Contract Documents or as agreed upon in the Preconstruction Conference.
- D. Submit results of CONTRACTOR quality control tests conducted to verify conformance with the Project requirements as specified in the Contractor Quality Control Plan and as requested by ENGINEER.

### **PART 2 PRODUCTS**

NOT USED

### **PART 3 EXECUTION**

NOT USED

## SECTION 01310

### ENVIRONMENTAL PROTECTION

#### PART 1 GENERAL

##### 1.1 SCOPE OF WORK

This section covers all labor, supplies, materials, equipment, and incidentals required for the protection of human health and the environment during all construction activities at the Site in compliance with the Contract Documents.

##### 1.2 REFERENCES

Publications listed below are incorporated into this specification by reference.

##### **Code of Federal Regulations (CFR), U.S. Environmental Protection Agency (EPA)**

40 CFR 68	Chemical Accident Prevention Provisions
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 279	Standards for the Management of Used Oil
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 355	Emergency Planning and Notification

##### 1.3 SUBMITTALS

##### **Environmental Protection Plan**

Prepare and submit a comprehensive Environmental Protection Plan (EPP) addressing known or potential environmental issues CONTRACTOR must address during construction no later than 10 days prior to the start of Work. Attach copies of all environmental permits, permit application packages, approvals to construct, notifications, certifications, reports, and termination documents as an appendix to the EPP.

##### 1.4 DEFINITIONS

- A. Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare, unfavorably alter ecological balances of importance to human life, affect other species of importance to humankind, or degrade the environment aesthetically, culturally and/or historically.
- B. Environmental protection is the prevention and control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, air, biological and cultural resources, and includes management of visual aesthetics; noise; solid, chemical, gaseous and liquid waste; radiant energy; and radioactive material, as well as other pollutants.
- C. CONTRACTOR generated hazardous waste describes materials that if abandoned or disposed of, may meet the definition of a hazardous waste in 40 CFR 261. These waste streams typically consist of material brought on-Site by CONTRACTOR to execute the Work, but are not fully consumed during

the course of construction. Examples include, but are not limited to, excess paint thinners (e.g., methyl ethyl ketone, toluene), waste thinners, excess paints, excess solvents, and waste solvents.

## 1.5 PROTECTION FEATURES

- A. Prior to start of any construction activities on-Site, CONTRACTOR and ENGINEER shall make a joint condition survey. Immediately following the survey, CONTRACTOR shall prepare a brief report including a plan describing the features requiring protection, which are not specifically identified on the Construction Drawings as environmental features requiring protection, along with the condition of trees, shrubs, and grassed areas immediately adjacent to construction areas and to CONTRACTOR's assigned storage area and access route(s), as applicable.
- B. Protect environmental features included in the survey report or indicated on the Construction Drawings, regardless of added complication to Work under the Contract. CONTRACTOR and ENGINEER shall sign the report upon mutual agreement of its accuracy and completeness.

## 1.6 SPECIAL ENVIRONMENTAL REQUIREMENTS

Comply with all applicable environmental laws and regulations.

## 1.7 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations from the Drawings and Special Provisions requested by CONTRACTOR which may have an adverse environmental impact will be subject to approval by ENGINEER and may require an extended review, processing, and approval time. ENGINEER reserves the right to reject any deviation, regardless of cost effectiveness, if ENGINEER determines that the proposed alternate method may have an adverse environmental impact.

## 1.8 NOTIFICATION

OWNER will notify CONTRACTOR in writing of any noncompliance with federal, state or local environmental laws or regulations, permits, and other elements of the EPP. Upon receipt of such notice, CONTRACTOR shall inform ENGINEER of the proposed corrective action and take such action when approved by ENGINEER. OWNER may issue an order stopping all or part of the Work until satisfactory corrective action has been taken. No time extensions shall be granted or equitable adjustments allowed to CONTRACTOR for any such stop-work suspensions. This is in addition to any other actions the OWNER may take under the Contract in law or equity.

## **PART 2 PRODUCTS**

NOT USED

## **PART 3 EXECUTION**

### 3.1 ENVIRONMENTAL PROTECTION PLAN

- A. The EPP will govern Site activities relating to pollution prevention and minimization, spill control and reporting, storm water management, noise and dust control, and compliance with federal, state, and local water, wastewater, air, and solid waste laws and regulations.
- B. The EPP shall address each topic at a level of detail commensurate with the environmental issue and required construction task(s). Identify and discuss topics or issues not identified in this section, but which CONTRACTOR considers necessary, after those items formally identified in this section.

- C. Incorporate other plans required under the Contract Documents to simplify preparation and consolidate plans into a single plan.
- D. Prior to submittal of the EPP, meet with ENGINEER for the purpose of discussing the implementation of the initial EPP, possible subsequent additions and revisions to the plan including any reporting requirements and methods for administration.
- E. Keep the EPP current and maintain a copy on-Site.
- F. Identify, implement, and submit for approval any additional requirements to be included in the EPP during construction. No requirement in this specification shall be construed as relieving CONTRACTOR of any applicable federal, state, or local environmental protection law and regulation.
- G. The EPP shall include, but not be limited to, the following:
  - 1. Name(s) of CONTRACTOR personnel responsible for ensuring adherence to the EPP.
  - 2. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the Site, if applicable.
  - 3. Name(s) and qualifications of person(s) responsible for training CONTRACTOR's environmental protection personnel.
  - 4. Description of CONTRACTOR's environmental protection personnel training program.
  - 5. A list of federal, state and local laws, regulations and permits related to environmental protection, pollution control, and abatement that are applicable to CONTRACTOR's proposed operations and the requirements imposed by those laws, regulations, and permits.
  - 6. Erosion and Sediment Control Plan identifying the type and location of the erosion and sediment controls to be installed in accordance with SECTION 02150 EROSION AND SEDIMENT CONTROL. The plan will include monitoring and reporting requirements to ensure that the control measures are in compliance with federal, state, and local laws and regulations.
  - 7. Construction Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and contain materials on the Site.
  - 8. Diversion and Dewatering Plan.
  - 9. Excavation Plan.
  - 10. Wind Erosion/Dust Control Plan describing dust control and abatement procedures. The plan will detail provisions to ensure that dust, debris, materials, trash, etc., do not become airborne and travel away from the Site. Describe the visual air monitoring program, including modifications to Site activities to further control dust if the results of the visual air monitoring program or ENGINEER perimeter air monitoring program, indicate unacceptable levels of dust.
  - 11. Weed Control Plan to address all operations at the project area and implement the plan throughout the Work to control spread of noxious weeds.
  - 12. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or non-use. Include measures for marking the limits of use areas and methods for protection of features to be preserved within authorized Work areas.
  - 13. Spill Prevention, Control, and Countermeasure (SPCC) Plan including the procedures, instructions, and reports to be used in the event of an unforeseen spill of a regulated substance.
  - 14. Disposal Plan identifying schedules, methods and disposal locations for non-hazardous solid waste, including debris. Include the following:
    - a. Identify Subcontractors responsible for transportation and disposal of solid waste, if applicable.

- b. Licenses or permits for any solid waste disposal sites that are not a commercially operated facility and documentation of the disposal facility's acceptance of the solid waste during construction.
  - c. A report detailing the non-hazardous solid waste diversion activities and indicating the total amount of waste generated and total amount of waste diverted in cubic yards or tons along with the percent that was diverted. The report shall be submitted on the first working day after the first quarter that non-hazardous solid waste has been disposed of and/or diverted and shall be for the previous quarter, i.e., the first working day of January, April, July, and October.
15. Recycling and Non-Hazardous Solid Waste Minimization Plan describing measures to reduce consumption of energy and natural resources. Include actions to reduce the volume of non-hazardous solid waste generated at the Site and compliance with and participation in federal, state, and local government sponsored recycling programs.
  16. Contaminant Prevention Plan identifying potentially hazardous substances to be used on the Site, the intended actions to prevent introduction of such materials into the air, water or ground, and provisions for compliance with federal, state, and local laws and regulations for the storage and handling of these materials. Include a copy of the Safety Data Sheets (SDS, formerly MSDS) and the maximum quantity of each hazardous material on-Site at any given time. Update the plan if new hazardous materials are brought on-Site or existing hazardous materials are removed from the Site.
  17. Wastewater Management Plan identifying the methods and procedures for management and/or discharge of wastewater directly derived from construction activities, including, but not limited to, cleanup, dewatering, and disinfection.
  18. Biological Resources Plan defining procedures for identifying and protecting both known and unknown biological resources on-Site discovered during the Work. Include methods to ensure the protection of known or discovered biological resources and identify lines of communication between CONTRACTOR personnel and ENGINEER.

### 3.2 PROTECTION OF ENVIRONMENTAL RESOURCES

Protect the environmental resources within the Project boundaries and those affected outside the limits of permanent Work under the Contract Documents during the entire length of the Contract. Confine all activities to areas defined by the Contract Documents. Mark or fence, with orange safety fence, undisturbed areas as indicated on the Construction Drawings. Foundations and structures shall be left undisturbed and in place, unless indicated in the Contract Documents or requested by ENGINEER.

### 3.3 LAND RESOURCES

Confine all activities to areas defined by the Contract Documents. Prior to the beginning of any construction, identify any land resources to be preserved within the Work area. Except in areas indicated in the Contract Documents, or as requested by ENGINEER, do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval from ENGINEER. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically approved by ENGINEER.

### 3.4 EROSION AND SEDIMENT CONTROLS

- A. Provide erosion and sediment control measures in accordance with federal, state, and local laws and regulations. Refer to SECTION 2150 EROSION AND SEDIMENT CONTROL for specific requirements.
- B. Select and maintain the erosion and sediment controls such that water quality standards are not violated as a result of the Work. Maintain the area of bare soil exposed at any one time by construction operations to a minimum.

- C. Construct or install temporary and permanent erosion and sediment control Best Management Practices (BMPs) as set forth in the Site-specific Erosion and Sediment Control Plan and as indicated on the Drawings or as requested by ENGINEER. BMPs may include, but are not limited to, vegetation cover, stream bank stabilization, slope stabilization, filter fences, straw wattle, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins.
- D. Remove temporary BMPs after the area has been stabilized.
- E. Provide erosion and sediment controls for on-Site borrow and spoil areas to prevent sediment from impacting nearby waters.
- F. Control temporary excavation and embankments for plant and/or work areas to protect adjacent areas.

### 3.5 WATER RESOURCES

- A. Monitor construction activities to prevent pollution of surface and ground waters and maintain all existing drainage patterns.
- B. Clear conveyance swales, ditches, and other areas at the Site of debris, materials, and equipment that may disrupt drainage.
- C. Utilize BMPs at the Site such that water turbidity does not exceed applicable standards at the point of compliance. If visible turbidity exists at the point of compliance due to disturbances upstream from construction activities, verify by measurement. If an exceedance occurs or appears to be imminent, perform corrective action(s) to mitigate the situation, including the halting of certain construction activities.

### 3.6 COFFERDAMS, DIVERSIONS, AND DEWATERING OPERATIONS

- A. Comply with all federal and state water quality standards and anti-degradation provisions. Control construction operations for dewatering, diverting, cofferdam removal, tailrace excavation, and tunnel closure at all times to maintain compliance with existing state water quality standards and designated uses of the surface water body.
- B. Comply with the requirements of the Clean Water Act Section 404 Nationwide Permit. OWNER will provide Site-specific information regarding the Clean Water Act Section 404 Nationwide Permit if applicable.
- C. Comply with provisions in these Technical Specifications.

### 3.7 STREAM CROSSINGS

Provide all necessary measures to allow movement of materials or equipment without violation of federal and state water pollution control standards at stream crossings.

### 3.8 AIR RESOURCES

- A. Perform equipment operation, activities, or processes in accordance with all federal, state, and local air emission and performance laws and standards.
- B. Control dust particles, aerosols, and gaseous byproducts from construction activities, processing, and preparation of materials at all times, including weekends, holidays, and hours when Work is not in progress.
- C. Control hydrocarbon and carbon monoxide emissions from equipment at all times to federal, state, and local allowable limits.



- D. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other Work areas within or adjacent to the Project boundaries free from particulates which would cause federal, state, and local air pollution standards to be exceeded or which would cause a hazard or a nuisance.
- E. Water or otherwise treat dust generating surfaces (including roads, staging, stockpile and waste placement areas) as often as necessary to comply with all federal and state standards for airborne particulates, and as requested by ENGINEER.
- F. Sprinkling or other methods will be permitted to control particulates in the Work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. Have sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the Work proceeds and whenever a particulate nuisance or hazard occurs. Comply with all federal, state, and local visibility regulations.
- G. Continuously monitor visual dust for the duration of construction activities. Perform a perimeter monitoring check on an interval of once every 4 hours and record the results of this monitoring in the daily notes.
- H. Control odors from construction activities at all times and maintain compliance with federal, state, and local regulations and ordinances.

### 3.9 SOUND INTRUSIONS

Control construction activities to comply with all federal, state, and local noise regulations.

### 3.10 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

- A. Conduct handling, storage, and disposal of materials properly to prevent contamination.
- B. Employ segregation measures to prevent commingling of hazardous or toxic waste with solid waste.
- C. Verify and obtain the necessary permits and licenses to operate for the selected transporters and disposal facilities.

### 3.11 CHEMICALS AND CHEMICAL WASTES

- A. Dispense chemicals in a manner that prevents spillage to ground or surface water.
- B. Periodically inspect dispensing areas to identify signs of leakage. Perform and document corrective action on identified areas of leakage. This documentation may be periodically reviewed by ENGINEER.
- C. Collect chemical waste in corrosion-resistant, compatible containers. Monitor collection drums/containers and remove drums/containers to a staging or storage area when contents are 90% full.
- D. Classify, manage, store, and dispose of wastes in accordance with federal, state, and local laws and regulations.
- E. Provide a manifest of all chemical disposal to ENGINEER.

### 3.12 CONTRACTOR GENERATED HAZARDOUS WASTES/EXCESS HAZARDOUS MATERIALS

- A. Comply with all federal and state laws concerning hazardous waste.
- B. At a minimum, manage and store hazardous waste in compliance with regulations. Use sufficient measures during dispensing of hazardous and toxic materials to prevent spillage.

- C. Segregate hazardous waste from other materials and wastes. Place wastes in a safe, covered location to protect from the weather and take precautionary measures such as berming or other appropriate actions to prevent accidental spillage.
- D. Store, describe, package, label, mark, and placard hazardous waste and hazardous material in accordance with federal, state, and local laws and regulations.
- E. Dispose of hazardous waste in compliance with federal, state, and local laws and regulations. Immediately report spills of hazardous or toxic materials to ENGINEER. CONTRACTOR is solely responsible for the cleanup and associated cleanup costs due to spills.

### 3.13 FUEL AND LUBRICANTS

- A. Conduct storage, fueling, and lubrication of equipment and motor vehicles in a manner that affords the maximum protection against spill and evaporation.
- B. Manage and store fuel, lubricants, and oil in accordance with all federal, state, and local laws and regulations.
- C. Discard and store used lubricants and oil in marked corrosion-resistant containers and recycle or dispose of in accordance with federal, state, and local laws and regulations.

### 3.14 WASTEWATER

- A. Wastewater from construction activities, such as material processing, etc. shall not be allowed to enter State or Federal waterways prior to verification that discharges meet federal, state, and local water pollution control standards, anti-degradation standards, and water quality criteria.
- B. Dispose of construction related wastewater in accordance with federal, state, and local laws and regulations.

### 3.15 WEED CONTROL

- A. CONTRACTOR shall prepare a Weed Control Plan to address all of CONTRACTOR's operations at the Site and implement the plan throughout the Work to control the spread of noxious weeds. Describe in the plan specific methods and procedures to prevent and/or minimize the spread of noxious weeds, and methods to collect and dispose of weed-contaminated wash water and/or soils. Describe chemical weed control locations, procedures, methods, and materials to be used (if applicable) in the plan.
- B. The minimum weed control measures to be implemented throughout the Work include, but are not limited to the following:
  - 1. Enter and exit the Site at the designated access points to minimize tracking of weeds into and around the Site.
  - 2. Establish weed washing/decontamination facilities at all Site access points used by CONTRACTOR and provide plans for how the areas will be operated, maintained, and decommissioned.
  - 3. Decontaminate all construction equipment to prevent the spread of noxious weeds before moving equipment into or away from the Project area.
  - 4. Decontaminate each piece of equipment, including supply trucks, delivery trucks, and Subcontractors' equipment each time it enters the Project area if it has been used at sites other than the Project area since it was last decontaminated. Request inspection of equipment prior to using in the Project area.
  - 5. Clean all wheels, tracks, undercarriages, fenders, blades, buckets, and the exterior body prior to entering the Site.

6. Decontaminate all equipment when moving equipment within the Project area if the equipment has been used in an area with noxious weeds. Notify ENGINEER when performing decontamination.
  7. Mark areas within and adjacent to the Project area with large weed populations and minimize vehicle travel through these areas, including walking traffic, and decontaminate equipment used in these areas as described above.
  8. Employ appropriate weed control measures at all aggregate sources to ensure delivery of weed-free materials and to prevent tracking or spread of weeds from the material source areas to the Site.
  9. Provide a parking area for CONTRACTOR, employees, suppliers, ENGINEER, and other persons in an area free from weed infestations.
  10. Provide training for all employees and Subcontractors on weed control methods and procedures specified in the Weed Control Plan, and ensure that these procedures are followed by employees, Subcontractors, and other on-Site personnel. Submit to ENGINEER a statement signed by each employee and Subcontractor stating they have been instructed in and agree to follow the protocol stated in the Weed Control Plan.
- C. Equipment shall be inspected and approved by ENGINEER prior to use at the Project area. If there is an abnormal growth of noxious weeds in the Project area after construction as determined by OWNER, ENGINEER or local weed control authority, CONTRACTOR shall be responsible for follow-up weed control under Paragraph 6.19 of the General Conditions.

### 3.16 HISTORICAL, ARCHEOLOGICAL AND CULTURAL RESOURCES

- A. Site-specific procedures for protecting historic archeological resources will be as directed by OWNER. Project personnel (excepting approved archaeologists) shall not for personal observation or use collect, move or in any other way alter any prehistoric or historic artifacts or features in the Project vicinity.
- B. If during excavation or other construction activities any previously unidentified or unanticipated potential prehistoric archaeological resources and/or human remains/burial(s) are discovered or found, suspend all Work that may damage or alter such resources.
- C. Resources include but are not limited to the following:
  1. Any human skeletal remains or burials.
  2. Prehistoric artifacts such as formed stone tools, projectile points (arrowheads or spear points), scrapers, and the debitage (flakes or chips) left over from forming tools; fire pits and rings; rock art, such as pictographs (rock paintings) or petroglyphs (pecked rock art); and any other artifacts or features indicating prehistoric human activities.
  3. Upon such findings, immediately notify ENGINEER so that the appropriate authorities may be notified and a determination made as to the significance of the resource and what, if any, special disposition of the finds should be made.
  4. Cease all Work that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.
- D. Within a maximum of 4 hours of the identification of an historic resource judged to be significant, all participating parties to the Contract will be notified. A representative of the State Historical Preservation Office (SHPO) shall visit the discovery within at least 1 business day to recommend how the historic resource should be treated. Options include avoidance, on-Site mitigation, off-Site mitigation, and additional recordation or investigation.
- E. Within 1 business day, OWNER will consider the findings and recommendations of SHPO and other qualified historian(s) or archaeologist(s) and make a final determination on actions to be taken. OWNER will consult with all parties involved in the construction activities and SHPO before finalizing their decision. All decisions will be documented to all participating parties to the Contract by OWNER and become part of the record.

### 3.17 BIOLOGICAL RESOURCES

- A. Minimize interference with, disturbance to, and damage to fish, wildlife, and plants including their habitat.
- B. Protect threatened and endangered animal and plant species including their habitat in accordance with federal, state, and local laws and regulations.

### 3.18 PREVIOUSLY USED EQUIPMENT

- A. Clean all previously used construction equipment prior to bringing it onto the Site. Ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds.
- B. Consult with the USDA jurisdictional office for additional cleaning requirements.

### 3.19 MAINTENANCE OF POLLUTION CONTROL (DECONTAMINATION) FACILITIES

Maintain all constructed facilities and portable pollution control devices for the duration of the Contract or for that length of time construction activities create the particular pollutant.

### 3.20 TRAINING OF CONTRACTOR PERSONNEL

- A. Train all personnel in all phases of environmental protection and pollution control.
- B. Conduct environmental protection/pollution control meetings for all CONTRACTOR personnel prior to commencing construction activities.
- C. Conduct additional meetings for new personnel and when Site conditions change.
- D. The training and meeting agenda shall include the following:
  - 1. Methods of detecting and avoiding pollution.
  - 2. Identifying, avoiding, and decontaminating for weeds.
  - 3. Familiarization with statutory and contractual pollution standards.
  - 4. Installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection and pollution control.
  - 5. Anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants.
  - 6. Recognition and protection of archaeological sites, artifacts, wetlands, and endangered species and their habitat that are known to be in the vicinity of the Project.

### 3.21 CONTAMINATED MEDIA MANAGEMENT

Manage contaminated environmental media consisting of, but not limited to, soils and sediments in accordance with SECTION 02210 EARTHWORK and SECTION 02211 EXCAVATION AND DISPOSAL OF MINE WASTE MATERIALS.

### 3.22 POST CONSTRUCTION CLEANUP

Clean up all areas used for construction in accordance with Paragraph 6.11.C of the General Conditions, unless otherwise instructed in writing by ENGINEER.

## SECTION 01320

### SAFETY, HEALTH, AND EMERGENCY RESPONSE

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section covers all labor, supplies, materials, equipment, and incidentals necessary for the implementation of practices and procedures for working safely and in compliance with OSHA regulations while performing Work at the Site. Not all tasks performed under the Contract will involve an exposure potential to the contamination present on-Site. The requirements of this specification section address all types of on-Site activities. The critical element for compliance within this specification is completion of an activity/job hazard analysis for each task specific to the Work performed at the Site.

##### 1.2 REFERENCES

Publications listed below are incorporated into this specification by reference.

#### **American National Standards Institute (ANSI)**

ANSI Z358.1                      Emergency Eyewash and Shower Equipment

#### **Code of Federal Regulations (CFR), U.S. Environmental Protection Agency (EPA)**

29 CFR 1904	Recording and Reporting Occupational Injuries and Illnesses
29 CFR 1910	Occupational Safety and Health (OSHA) Standards
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response (HAZWOPER)
29 CFR 1910.141	Sanitation
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1910.147	Control of Hazardous Energy (Lockout/Tagout)
29 CFR 1910.212	General Requirements for all Machines
29 CFR 1910.1030	Bloodborne Pathogens
29 CFR 1910.1200	Hazard Communication
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.24	Fire Prevention and Prevention
29 CFR 1926.56	Illumination
29 CFR 1926.62	Lead
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
29 CFR 1926.352	Fire Prevention
29 CFR 1926 Subpart K	Electrical
29 CFR 1926 Subpart M	Fall Protection
29 CFR 1926.651	Specific Excavation Requirements
29 CFR 1926.1118	Inorganic Arsenic
29 CFR 1926.1127	Cadmium
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans

## **National Institute for Occupational Safety and Health (NIOSH)**

NIOSH 0500	Particulates Not Otherwise Regulated, Total
NIOSH 7300	Elements by ICP (Nitric/Perchloric Acid Ashing)

## **Occupational Safety and Health Administration (OSHA)**

OSHA 125G	Metal and Metalloid Particulates in Workplace Atmospheres (ICP Analysis)
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### **1.3 SUBMITTALS**

#### **Corporate Health and Safety Plan**

Submit CONTRACTOR's Corporate Health and Safety Plan to ENGINEER no later than 10 days prior to the start of Work.

#### **Accident Prevention Plan/Site-Specific Health and Safety Plan**

Prepare and submit an Accident Prevention Plan/Site-Specific Health and Safety Plan (APP/SSHSP) that meets the all requirements needed to address the Work under the Contract no later than 10 days prior to the start of Work.

#### **Exposure Monitoring Program**

Prepare and submit an Exposure Monitoring Program if required in CONTRACTOR's Corporate Health and Safety Plan or APP/SSHSP. Submit personnel exposure monitoring results at the interval(s) described in the Exposure Monitoring Program and summarize in a report generated at the end of the Project. Notify ENGINEER as soon as possible, but no later than 24 hours following any results that exceed established action levels.

## **PART 2 PRODUCTS**

NOT USED

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Per Article 6.13 of the General Conditions, CONTRACTOR shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work.
- B. Failure to comply with all applicable safety requirements is cause for immediate Work stoppage and/or grounds for termination of the Contract.
- C. Comply with all applicable safety laws, regulations, and standards.
- D. At a minimum, comply with the following general safety requirements at all times for the duration of the Project:
  - 1. Employees of CONTRACTOR and Subcontractor shall wear the following Personal Protective Equipment (PPE): hard hat, high-visibility safety vest, safety toe shoes, and safety glasses with side shields.
  - 2. Employees of CONTRACTOR and Subcontractor shall not operate cellular phones while driving.
  - 3. Employees of CONTRACTOR and Subcontractor shall wear safety (seat) belts at all times when driving a vehicle or operating equipment.

4. First aid kits and fire extinguishers are required in all field vehicles and equipment.
5. No drugs, alcohol, or firearms are allowed on-Site or in employees' vehicles.
6. No eating or drinking is allowed in the Work area.

### 3.2 PRECONSTRUCTION SAFETY CONFERENCE

Conduct a Preconstruction Safety Conference prior to the start of Site activities and after submission of CONTRACTOR's APP/SSHSP to discuss health and safety concerns related to the upcoming Work, Project health and safety organization and expectations, and to review and answer comments and concerns regarding the APP/SSHSP or other health and safety concerns related to the Project. Ensure attendance at the conference by the individuals responsible for health and safety at the Project level.

### 3.3 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

- A. Designate an individual as the Safety and Health Manager (SHM) who will be responsible for the development and ongoing maintenance of the APP/SSHSP. The qualifications of the SHM include the following:
  1. Appropriate training and experience.
  2. Documented experience in supervising professional and technician level personnel.
  3. Documented experience in developing safety and health programs, including air monitoring, PPE, and safety programs for the hazards likely to be encountered on the Project.
  4. Working knowledge of federal and state occupational safety and health laws and regulations.
  5. The SHM duties include the following:
    - a. Responsible for the development of the APP/SSHSP.
    - b. Sign and date the APP/SSHSP before submittal.
    - c. Conduct initial Site-specific health and safety training.
    - d. Availability for consultation or emergencies for the duration of the Project.
    - e. Visit the Site as needed for the duration of the Project to audit the effectiveness of the APP/SSHSP.
    - f. Coordinate any modifications to the APP/SSHSP with the Site Superintendent, SSHO, and ENGINEER.
    - g. Evaluate air monitoring data and recommend changes to engineering controls, Work practices, and PPE.
    - h. Review accident reports and results of daily inspections.
    - i. Serve as a member of CONTRACTOR's quality control staff on matters relating to safety and health.
- B. Designate an individual (and an alternate) as the Site Safety Health Officer (SSHO). The qualifications of the SSHO include the following:
  1. Appropriate training and experience.
  2. Documented experience in construction techniques and construction safety procedures.
  3. Working knowledge of federal and state occupational safety and health regulations.
  4. Specific training in personal and respiratory protective equipment, confined space entry and the proper use of air monitoring instruments and air sampling methods, including monitoring for ionizing radiation, as appropriate.

5. The SSHO duties include the following:
- a. Conduct on-Site training and day to day on-Site implementation and enforcement of the accepted APP/SSHSP.
  - b. Assigned to the Site on a full-time basis for the duration of the Work. The SSHO may have collateral duties in addition to Safety and Health related duties, such as CONTRACTOR Quality Control Systems Manager. If operations are performed during more than 1 work shift per day, a SSHO shall be present for each shift.
  - c. Authority to ensure Site compliance with specified safety and health requirements, federal, state and OSHA regulations and all aspects of the APP/SSHSP including, but not limited to, the following:
    - 1. Activity hazard analyses.
    - 2. Air monitoring.
    - 3. Use of PPE.
    - 4. Decontamination.
    - 5. Site control.
    - 6. Standard Operating Procedures (SOP) to minimize hazards.
    - 7. Safe use of engineering controls.
    - 8. Emergency response plan.
    - 9. Confined space entry procedures
    - 10. Heat and cold stress monitoring program.
    - 11. Spill containment program.
  - d. Authority to stop Work if unacceptable health or safety conditions exist and take necessary action to re-establish and maintain safe working conditions.
  - e. Consult with and coordinate any modifications to the APP/SSHSP with the Site Superintendent and ENGINEER.
  - f. Serve as a member of CONTRACTOR's quality control staff on matters relating to safety and health.
  - g. Conduct accident investigations and prepare accident reports.
  - h. Conduct daily safety inspection and document safety and health findings into the Daily Safety Inspection Log. Track noted safety and health deficiencies to ensure that they are corrected.
  - i. Recommend corrective actions for identified deficiencies and oversee the corrective actions.
- C. At least two (2) personnel currently certified in first aid and CPR by the American Red Cross or other approved agency shall be on-Site at all times during Site operations and shall be trained in universal precautions and the use of PPE as described in 29 CFR 1910.1030. These persons may perform other duties, but shall be immediately available to render first aid and CPR when needed.

### 3.4 TRAINING

CONTRACTOR's training program for workers performing cleanup operations or tasks covered under the Contract and who will be exposed to contaminants shall meet the following requirements:

- A. All Personnel performing duties with potential for exposure to on-Site contaminants shall meet and maintain the following 29 CFR 1910.120/29 CFR 1926.65(e) training requirements:
  - 1. 40-Hour Hazardous Waste Operation and Emergency Response certificates.



- 2. 8-Hour Hazardous Waste Operations and Emergency Response annually.
- B. On-Site supervisors shall have an additional 8 hours of management and supervisor training as specified in 29 CFR 1910.120/29 CFR 1926.65(e)(4).

### 3.5 PERSONAL PROTECTIVE EQUIPMENT

- A. Provide appropriate PPE for on-Site personnel exposed to contaminants.
- B. Use only respirators approved by the National Institute for Occupational Safety and Health (NIOSH).
- C. Keep protective equipment and clothing clean and well maintained.
- D. Include in the PPE section of the APP/SSHSP Site-specific procedures to determine PPE program effectiveness level, on-Site fit-testing of respirators, and cleaning, maintenance, inspection, and storage of PPE.
- E. Provide to ENGINEER any specialty PPE required beyond Level D.

### 3.6 MEDICAL SURVEILLANCE PROGRAM

Complete the medical surveillance program for workers performing cleanup operations as stated in CONTRACTOR's Corporate Health and Safety Plan.

### 3.7 EXPOSURE MONITORING PROGRAM

- A. Prepare and implement an exposure monitoring program to comply with OSHA requirements and ensure proper selection of engineering controls, work practices, and PPE for affected Site personnel.
- B. Perform personal exposure monitoring at an appropriate frequency and coverage for Site-specific work tasks and define the action levels requiring a modification of initial PPE selection.

### 3.8 HEAT AND COLD STRESS MONITORING AND MANAGEMENT

- A. Include in the APP/SSHSP procedures and practices to monitor and manage heat and cold stress for on-Site activities. Describe details of the monitoring program, including schedules for work and rest, and physiological monitoring requirements.
- B. Train personnel to recognize the symptoms of heat and cold stress.

### 3.9 CONFINED SPACE ENTRY PROCEDURES

Identify confined spaces during the hazard evaluation and address confined space entry procedures in accordance with 29 CFR 1910.146.

### 3.10 HOT WORK

Address hot work safety procedures in accordance with 29 CFR 1926.352.

### 3.11 IGNITION SOURCES

Identify any and all ignition sources which could pose potential fire hazards or other hazards at the Site.

### 3.12 FIRE PROTECTION AND PREVENTION

Address fire protection and prevention procedures in accordance with 29 CFR 1926.24.

### 3.13 ELECTRICAL SAFETY

Address electrical safety requirements and procedures in accordance with 29 CFR 1926 Subpart K.

### 3.14 EXCAVATION AND TRENCH SAFETY

Comply with excavation and trench safety requirements specified in 29 CFR 1926.651.

### 3.15 GUARDING OF MACHINERY AND EQUIPMENT

Comply with guarding of machinery and equipment requirements specified in 29 CFR 1910.212.

### 3.16 LOCKOUT/TAGOUT

Comply with lockout/tagout requirements specified in 29 CFR 1910.147.

### 3.17 FALL PROTECTION

Comply with fall protection and safe access requirements specified in 29 CFR 1926 Subpart M.

### 3.18 HAZARD COMMUNICATION

Comply with hazard communication requirements specified in 29 CFR 1910.1200.

### 3.19 ILLUMINATION

Comply with illumination requirements specified in 29 CFR 1926.56.

### 3.20 SANITATION

Comply with sanitation requirements specified in 29 CFR 1910.141.

### 3.21 ENGINEERING CONTROLS

Provide engineering controls to mitigate task hazards, including, but not limited to dust control.

### 3.22 VEHICLE SAFETY

Comply with the following on-Site vehicle safety requirements:

1. Do not operate cellular phones while driving a vehicle or operating equipment.
2. Observe safe operating speeds when driving on haul roads.
3. Limit small vehicle traffic within the Work area to supervisory personnel.
4. Wear safety (seat) belts at all times when driving a vehicle or operating equipment.
5. Include first aid kits and fire extinguishers in all field vehicles and equipment.

6. No drugs, alcohol, or firearms are allowed on-Site or in CONTRACTOR or Subcontractor employee vehicles.

### 3.23 EMERGENCY COMMUNICATION

Equip all vehicles, equipment and personnel with radios and maintain radio communication at all times. In areas with limited cellular network coverage, equip all key personnel vehicles with a cellular phone booster that is tested for functionality prior to the start of the Work.

### 3.24 SIGNS AND LABELS

Signs and labels shall be addressed as necessary to comply with 29 CFR 1910.1200.

### 3.25 WORK ZONES

- A. Establish and delineate Site work zones as required.
- B. Delineation of work zone boundaries shall be based on the contamination characterization data and the hazard/risk analysis to be performed. As the Work progresses and field conditions change, work zone boundaries may be modified (using Site maps showing the modified boundaries) with approval of the ENGINEER.
- C. Post a Site map, showing work zone boundaries and locations of decontamination facilities, in the on-Site office. Work zones shall consist of the following:
  1. Exclusion Zone (EZ) is the area where hazardous contamination is either known or expected to occur and the greatest potential for exposure exists. Control entry into this area and exit only through the Contamination Reduction Zone (CRZ).
  2. Contamination Reduction Zone is the transition area between the EZ and the Support Zone (SZ). The personnel and equipment decontamination areas shall be separate and unique areas located in the CRZ.
  3. Support Zone is defined as an area of the Site, other than the EZ and CRZ, where workers do not have the potential to be exposed to hazardous substances or dangerous conditions resulting from hazardous waste operations. Secure the SZ against active or passive contamination. Locate Site offices, parking areas, and other support facilities in the SZ.

### 3.26 SITE CONTROL LOG

- A. Maintain a log of personnel visiting, entering, or working on the Site that includes the following: date, name, agency or company, time entering and exiting the Site, and time entering and exiting the EZ (if applicable).
- B. Before visitors are allowed to enter the CRZ or EZ, they shall show proof of current training, medical surveillance, and respirator fit testing (if respirators are required for the tasks to be performed) and shall fill out a Certificate of Worker or Visitor Acknowledgment.
- C. Record the visitor information, including date, in the log. Review the log at the end of the day to determine whether all personnel visiting, entering, or working on the Site have signed in and out.

### 3.27 SITE SECURITY

Establish Site security procedures that meet the work zone requirements. Provide to OWNER and ENGINEER copies of keys or combinations to any locks used on-Site.

### 3.28 PERSONAL HYGIENE AND DECONTAMINATION

- A. Provide personal hygiene and decontamination facilities as required to complete the Work as specified.
- B. Where required, submit a detailed discussion of personal hygiene and decontamination facilities and procedures to be followed by Site workers as part of the APP/SSHSP.
- C. Train employees in the decontamination procedures and enforce the procedures throughout Site operations.

### 3.29 EQUIPMENT DECONTAMINATION

- A. Decontaminate vehicles and equipment used in the EZ in the CRZ prior to leaving the Site.
- B. Provide a vehicle and equipment decontamination station within the CRZ for vehicles and equipment leaving the EZ. Determine the most effective means of decontaminating vehicle and equipment based on the task specific hazard analysis performed. Describe reasonable methods to be considered, based on the tasks covered under the Contract, in the APP/SSHSP.
- C. Decontamination items to be considered include, but are not limited to, the following:
  - 1. A high pressure, low volume water wash area for equipment and vehicles.
  - 2. Steam cleaning system for use after mud and/or Site material has been cleaned from the equipment.
  - 3. A broom for dry decontamination to only remove clumps of soil/loose spilled materials on accessible surfaces in such a manner as to prevent dust generation.
- D. Develop and utilize procedures for equipment decontamination to prevent the spread of contamination into the SZ and off-Site areas. These procedures shall address disposal of contaminated products and spent materials used on the Site, including containers, fluids, oils, etc.
- E. Assume that any item taken into the EZ is contaminated and requires inspection and decontamination before being allowed to enter the SZ.
- F. Clean and decontaminate vehicles, equipment, and materials prior to leaving the Site. Handle construction material in such a way as to minimize the potential for contaminants being spread and/or carried off-Site. Prior to exiting the Site, monitor vehicles and equipment to ensure the adequacy of decontamination.

### 3.30 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS

Maintain the following items, as a minimum, on-Site and available for immediate use:

- 1. First aid equipment and supplies.
- 2. Emergency eyewash stations and showers that comply with ANSI Z358.1, if required for employee protection based on the task hazard analysis.
- 3. Provide and maintain fire extinguishers of sufficient size and type at Site facilities and in all vehicles and equipment and at any other Site locations where flammable or combustible materials present a fire risk.

### 3.31 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

- A. Develop and implement an Emergency Response Plan, that meets the requirements of 29 CFR 1910.120(l) and 29 CFR 1926.65(l), as a part of the APP/SSHSP.
- B. In the event of any emergency, perform the following:

1. Immediately alert all on-Site personnel, ENGINEER, and if necessary, off-Site emergency responders.
  2. Where safe to do so, take action to remove or otherwise minimize the cause of the emergency.
  3. Institute measures necessary to prevent a repeat of the conditions or actions leading to or resulting in the emergency.
- C. Train employees that are required to respond to hazardous emergency situations to the level of their responsibility according to 29 CFR 1910.120(q) and 29 CFR 1926.65(q) requirements. Rehearse the emergency plan regularly as part of the overall training program for Site operations.
- D. Review the plan periodically and revise as necessary to reflect new or changing Site conditions or information. Provide copies of the Emergency Response Plan portion of the accepted APP/SSHSP to the applicable local emergency response agencies.

### 3.32 INSPECTIONS

Attach and submit the SSHO Daily Inspection Logs with the Daily Quality Control reports. Include in each entry the following: date and time, Work area checked, employees present in Work area, PPE and work equipment used in each area, special safety and health issues and notes, and signature of preparer.

## **SECTION 01330**

### **WINTERIZATION**

#### **PART 1 GENERAL**

##### **1.1 DESCRIPTION**

This section covers all labor, supplies, materials, equipment, and incidentals necessary for furnishing and installing temporary surface erosion control materials to prepare exposed soil and disturbed soil surfaces at the Site for winter in compliance with the Contract Documents. Work may also include the construction of temporary storm water channels, berms, or other runoff control structures, at locations requested by ENGINEER, to prevent runoff from the Site during spring melt and runoff.

##### **1.2 SUBMITTALS**

###### **Winterization Plan**

Prepare and submit a Winterization Plan a minimum of 21 days before seasonal shutdown and demobilization at the Site.

#### **PART 2 PRODUCTS**

NOT USED

#### **PART 3 EXECUTION**

##### **3.1 GENERAL**

- A. Actively track weather near the end of the construction season to identify significant weather patterns that may force winter shutdown. Coordinate with ENGINEER to determine when winter shutdown winterization is to occur.
- B. If a winter shutdown period is included in the Contract Documents, costs for preparing and implementing the winterization plan, demobilization, remobilization, and repairs and remedies from winter damage, are incidental to the Work and no separate payment will be made.

##### **3.2 WINTERIZATION PLAN**

- A. ENGINEER, OWNER, and CONTRACTOR will conduct a walk-through of the Site to determine winter shutdown needs.
- B. Based on the information from the Site walk-through, prepare a Winterization Plan describing, at a minimum, the following:
  - 1. Site map showing all disturbed or unreclaimed areas at the Site.
  - 2. List of materials and products that will be stored on-Site over the winter. Specify methods to be employed to protect the materials and products from damage or theft. Specify methods to control any spills or leaks from products stored at the Site.
  - 3. Identify and specify appropriate BMPs and erosion control practices that will be employed to control erosion and prevent contamination of storm water runoff until construction resumes.

4. Specify Site access controls to limit unauthorized access to the Site throughout the winter shutdown.
  5. Identify any diversion or dewatering efforts that will continue throughout the winter. Specify measures to prevent unauthorized access to trenches or open channels. Specify how the areas will be accessed, maintained, and operated. Ensure that all measures are adequate and capable of addressing harsh winter and high flow spring runoff conditions.
  6. Specify a winter inspection plan and schedule.
  7. Identify any surface diversions or pipe openings that need to be inspected or maintained before spring runoff.
  8. All other information necessary depending on Site-specific conditions.
- C. Complete a Site walk-through with ENGINEER and OWNER to review the plan and obtain ENGINEER's approval of the plan.

### 3.3 WINTERIZATION

- A. Implement all measures described in CONTRACTOR's winterization plan.
- B. Demobilize all unnecessary equipment, materials, and supplies from the Site.
- C. Complete a walk-through and inspection of all measures implemented at the Site to verify that the Site is ready for winter. ENGINEER will participate in the walk-through and inspection.
- D. Complete Site inspections as required.
- E. Track weather and spring flooding conditions, update the plan as necessary, and implement all changes.
- F. Coordinate with ENGINEER to identify and implement additional measures as needed.
- G. Obtain approval of all winterization measures from ENGINEER.

### 3.4 REMOBILIZATION AFTER WINTER

- A. Remobilize to the Site.
- B. Remove all temporary controls.
- C. Repair damaged areas and re-establish BMPs as needed.
- D. Resume Work at the Site.

## **SECTION 01400**

### **CONTRACTOR QUALITY CONTROL**

#### **PART 1 GENERAL**

##### **1.1 DESCRIPTION**

This section covers CONTRACTOR requirements to furnish all labor, materials, equipment, and incidentals required to prepare and update a quality control system to complete the Work at the Site in compliance with requirements of the Contract Documents.

##### **1.2 SUBMITTALS**

###### **Contractor Quality Control Plan**

Prepare and submit a Contractor Quality Control (CQC) Plan for the Project specifically to implement the requirements of Article 13 of the General Conditions no later than 10 days prior to the start of the Work. Include all other items as necessary. The CQC Plan shall identify personnel, procedures, controls, inspections, instructions, tests, records, and forms to be used to demonstrate the quality of the Work. Construction will be permitted to begin only after acceptance of the CQC Plan applicable to the particular features of the Work to be started. Work outside of the features of the Work included in an accepted CQC Plan will not be permitted to begin until acceptance of an updated CQC Plan for the additional features of the Work.

###### **Material Testing Laboratory Qualifications**

As part of the CQC Plan, submit the qualifications for the selected material testing laboratory. Obtain approval of the materials testing laboratory from ENGINEER for all tests required by the Contract Documents.

#### **PART 2 PRODUCTS**

NOT USED

#### **PART 3 EXECUTION**

##### **3.1 GENERAL REQUIREMENTS**

- A. CONTRACTOR is responsible for all quality control to ensure that the Work complies with the requirements of the Contract Documents in accordance with Paragraphs 6.01 and 6.02 of the General Conditions.
- B. Quality Control is the means by which CONTRACTOR ensures that the Work performed, including that of Subcontractors and suppliers, complies with the requirements of the Contract Documents. The controls shall be adequate to cover all operations, including analytical testing and fabrication both on-Site and off-Site. Such controls will be keyed to the proposed construction sequence. Inspect all definitive features of the Work.
- C. ENGINEER will perform quality assurance testing, construction oversight, and additional testing necessary to verify that the Work performed by CONTRACTOR meets all applicable requirements.
- D. Establish, maintain and implement an effective quality control system with all plans, procedures, and organization necessary to produce an end product in compliance with the requirements of the Contract Documents.



Documents. The quality control system shall cover all construction operations, both on-Site and off-Site and be correlated to the proposed construction sequence.

- E. The Site Project Superintendent shall be responsible for the quality of the Work on the Project and is subject to removal by ENGINEER for noncompliance with the quality requirements specified in the context of this specification. The Site Project Superintendent shall be the highest level manager responsible for overall construction activities at the Site, including quality and production and shall maintain a physical presence at the Site at all times, except as otherwise acceptable to ENGINEER. The Site Project Superintendent shall be responsible for all construction and construction related activities at the Site. CONTRACTOR shall not replace the Site Project Superintendent without written notice to OWNER and ENGINEER.

### 3.2 CQC PLAN

- A. The CQC Plan covers all construction operations, including work by Subcontractors, fabricators, suppliers, and purchasing agents, both on-Site and off-Site.
- B. Prepare a CQC Plan including, but not limited to, the following:
  - 1. Description of the quality control organization, including an organizational chart showing lines of authority and acknowledgment that CQC Plan staff shall implement the features for all aspects of the Work specified.
  - 2. Name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC Plan function. Identify the name and qualifications of the Quality Manager who is responsible for implementing all aspects of the CQC Plan and reports to the Site Project Superintendent.
  - 3. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of Subcontractors, fabricators, suppliers, and purchasing agents.
  - 4. List of all materials and products that will require laboratory testing for the Project and the laboratory and test methods that will be used.
  - 5. List of all materials, products, and sources that require inspection and approval from ENGINEER.
  - 6. Procedures for inspection, control, verification, and acceptance testing for each specific test, including the test name, specification paragraph requiring test, feature of the Work to be tested, test frequency, and person responsible for each test. Use only laboratory facilities approved by ENGINEER.
  - 7. Procedures for tracking preparatory, initial, and follow-up control, verification, and acceptance tests including documentation.
  - 8. Procedures for tracking construction deficiencies from identification through acceptable corrective action to establish verification that identified deficiencies have been corrected.
  - 9. Reporting procedures, including proposed reporting formats.
  - 10. List of the definable features of the Work. A definable feature is a task separate and distinct from other tasks with separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of the Work, there is frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

### 3.3 ACCEPTANCE OF CQC PLAN

- A. Acceptance of the CQC Plan is required prior to the start of Work. Acceptance is conditional and will be predicated on satisfactory performance during the Contract. ENGINEER may reserve the right to

require CONTRACTOR to make changes to the CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

- B. After acceptance of the CQC Plan, notify ENGINEER in writing of any proposed changes. Proposed changes are subject to acceptance by ENGINEER.

### 3.4 COORDINATION MEETING

- A. Prior to acceptance by ENGINEER of the CQC Plan, meet with OWNER and ENGINEER to discuss the plan after the Preconstruction Conference and before start of the Work. The purpose of this meeting is to achieve a mutual understanding of the CQC process details. Items to discuss include, but are not limited, to the following:
  - 1. Forms for recording the CQC operations.
  - 2. Control activities.
  - 3. Testing.
  - 4. Administration of the system for Work both on-Site and off-Site.
  - 5. The interrelationship between CONTRACTOR's management and quality control with quality assurance of ENGINEER.
- B. Minutes of the meeting will be prepared by ENGINEER and signed by both CONTRACTOR and ENGINEER. The minutes shall become a part of the Contract file.
- C. Subsequent conferences may be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures that require corrective action by CONTRACTOR.

### 3.5 QUALITY CONTROL ORGANIZATION AND PERSONNEL

Designate a CQC Manager, additional qualified personnel, and appropriate resources to implement the CQC Plan and comply with the Contract Documents.

### 3.6 CQC MANAGER

- A. Identify as CQC Manager an individual within the on-Site work organization who shall be responsible for overall management of the CQC and have the authority to act in all CQC matters for CONTRACTOR.
- B. The CQC Manager shall be an experienced construction person with a minimum of 3 years of experience in related work such as investigations, studies, design, and remedial actions at similar sites. The CQC Manager may be assigned other duties provided they have sufficient resources and capacity to perform responsibly in all designated roles.
- C. The CQC Manager shall be available to visit the Site at all times during the Work to verify compliance and will be employed by CONTRACTOR.
- D. Identify an alternate individual for the CQC Manager in the CQC Plan to serve in the event of the designated CQC Manager's absence. Period of absence may not exceed 3 weeks at any one time. The qualification requirements for the alternate are the same as for the designated CQC Manager.

### 3.7 SUBMITTALS AND DELIVERABLES

The CQC Manager is responsible for certifying that all CONTRACTOR submittals are in compliance with the Contract Documents. Use standard report forms for submittal of any required data subject to the approval of ENGINEER.

### 3.8 INSPECTIONS

- A. Perform a preparatory inspection prior to beginning any definable feature of the Work, including, but not limited to, the following:
  - 1. Review of the Contract Documents requirements.
  - 2. Confirm that all materials and/or equipment have been tested, submitted, and approved.
  - 3. Confirm that provisions have been made to provide required control testing.
  - 4. Examination of the Work area to verify that all preliminary work has been completed.
  - 5. Physical examination of materials, equipment, and sample work to confirm compliance with the approved shop drawings, submittals, and that all materials and/or equipment are on-hand.
- B. Progress Inspections
  - 1. Perform an initial inspection as soon as a representative portion of the particular feature of the Work has been accomplished.
  - 2. Examine the quality of workmanship and review the control testing for compliance with requirements of the Contract Documents, use of defective or damaged materials, omissions, and dimensional requirements.
- C. Follow-up Inspections
  - 1. Perform follow-up inspections daily to confirm continuing compliance with requirements of the Contract Documents, including control testing, until completion of the particular feature of the Work.
  - 2. Record these inspections as a matter of record in the CQC Plan documentation.
  - 3. Conduct final follow-up inspections and correct deficiencies prior to the addition of new features of the Work.

### 3.9 TESTING

- A. Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to requirements of the Contract Documents. Individual specification sections may also require additional testing.
- B. Submit all materials test reports on forms standard to industry standards such as ACI, ASTM, and AASHTO. Upon request, furnish to ENGINEER duplicate samples of test specimens for possible testing by OWNER.
- C. Testing includes operation and/or acceptance tests when specified.
- D. Procure the services of a material testing laboratory in advance of any and all required testing. Submit the material testing laboratory qualifications for ENGINEER approval as part of the CQC Plan.
- E. Verify and record the following:
  - 1. Verify that testing procedures comply with requirements of the Contract Documents.
  - 2. Verify that facilities and testing equipment are available and comply with testing standards.
  - 3. Check test instrument calibration data against certified standards.
  - 4. Verify that the recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
  - 5. Record all tests results (passing, failing, and uncertain) on the CQC report. Note specification paragraph reference, location where tests were taken, and the sequential control number identifying

the test. If approved by ENGINEER, actual test reports may be submitted later with a reference to the test number and date taken.

6. Provide an informational copy of tests performed by an off-Site or commercial test facility directly to ENGINEER. Failure to submit timely test reports as stated may result in delayed payment for unverified Work performed and disapproval of the test facility for the Contract.

### 3.10 MATERIALS TESTING LABORATORIES

- A. Provide the services of an independent materials testing laboratory for tests required by the Contract Documents.
- B. Provide qualified personnel to perform specified inspection, sampling and testing of materials, and methods of construction. Comply with specified standards.
- C. Maintain and calibrate testing equipment in accordance with the specified test methods and laboratory quality control procedures. Make calibration records available to ENGINEER for inspection upon request.
- D. Employment of a testing laboratory shall in no way relieve CONTRACTOR from obligations to perform the Work in accordance with the Contract Documents.
- E. Submit written reports and test results within 7 days of receipt by CONTRACTOR.
- F. Costs incidental to the transportation of samples or materials are not considered separate from the Contract Documents.

### 3.11 ON-SITE LABORATORY

ENGINEER may utilize CONTRACTOR's control testing laboratory and equipment to perform assurance tests and to check CONTRACTOR's testing procedures, techniques, and test results at no additional cost to OWNER.

### 3.12 COMPLETION INSPECTION

#### A. Punch List

1. At the completion of all Work or any increment thereof, the CQC Manager shall conduct an inspection of the Work and develop a "punch list" of items that do not conform to the Contract Documents.
2. CQC Manager shall include the list of deficiencies, along with the estimated deficiency correction completion date, in the CQC Plan documentation.
3. CQC Manager or other CQC staff shall make a second inspection to ascertain that all deficiencies have been corrected. Complete these inspections and any deficiency corrections required within the time stated for completion of the Work or any particular increment thereof, if the Project is divided into increments by separate completion dates.
4. Upon completion of these inspections and correction of deficiencies, notify ENGINEER that the facility is ready for the Pre-Final Inspection.
5. If requested by CONTRACTOR, ENGINEER may assist with any punch list inspections.

#### B. Pre-Final Inspection

1. OWNER, CQC Manager, and ENGINEER will inspect the Site to verify that the Work is complete and identify any outstanding or uncompleted punch list items.
2. CQC Manager shall prepare a final punch list of any outstanding items and ensure that all items on the list are corrected in a timely manner.

3. Notify ENGINEER upon correction of deficiencies that a Final Acceptance Inspection can be scheduled.

C. Final Acceptance Inspection

1. ENGINEER will formally schedule the Final Acceptance Inspection at least 7 days prior to the inspection date. OWNER, CQC Manager, and ENGINEER shall be in attendance.
2. Confirm that all specific items previously identified to CONTRACTOR as being unacceptable, along with all remaining Work performed under the Contract Documents, are complete and acceptable by the date scheduled for the Final Acceptance Inspection.

### 3.13 CQC PLAN DOCUMENTATION

- A. Maintain current records of quality control operations, activities, and tests performed, including the work of Subcontractors and suppliers.
- B. Maintain these records in acceptable form with complete description of inspections, the results of inspections, daily activities, tests, and other items, including but not limited to the following:
  1. CONTRACTOR/Subcontractor and their area of responsibility.
  2. Operating plant and equipment with hours worked, idle, or down for repair.
  3. Work performed each day, with location, description, and by whom.
  4. Test and/or control activities performed with results and references to specified requirements. The control phase should be identified (e.g., Preparatory, Initial, or Follow-up). List deficiencies along with corrective action.
  5. Material received with statement as to its acceptability and storage.
  6. Submittals reviewed, with the Contract Document reference, action taken, and by whom.
  7. Off-Site surveillance activities, including actions taken.
  8. Job safety evaluations including what was checked, results, and instructions or corrective actions.
  9. List of instructions given and/or received and conflicts in the Contract Documents.
  10. Estimated volume of materials hauled based on truck counts or other approved estimation method, including both daily and cumulative volumes.
  11. Description of trades working on the Project, including the number of personnel working.
  12. Weather conditions encountered and any delays encountered.
  13. Conforming and deficient features, including a statement that equipment and materials incorporated in the Work and the workmanship comply with the Contract Documents.
- C. Furnish in report form to ENGINEER within 24 hours after the date(s) covered by the report. Do not submit a report for days on which no Work is performed.
- D. CONTRACTOR's verification statement noting the review and approval of report.
- E. The first report following a day of no Work shall be for that day only. The CQC Manager shall sign and date each report. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

### 3.14 NOTIFICATION OF NONCOMPLIANCE

- A. ENGINEER will notify CONTRACTOR of any noncompliance with the above-mentioned requirements. Such notice, when delivered to CONTRACTOR at the Site of the Work, shall be deemed sufficient for the purpose of notification.

- B. After receipt of noncompliance notice, CONTRACTOR shall immediately take corrective action. If CONTRACTOR fails or refuses to comply promptly, ENGINEER may issue an order stopping all or part of the Work until satisfactory corrective action(s) has been taken.
- C. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by CONTRACTOR.

## **SECTION 01500**

### **CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS**

#### **PART 1 GENERAL**

##### **1.1 DESCRIPTION**

This section covers requirements for providing and maintaining construction facilities and temporary controls at the Site in compliance with the Contract Documents.

##### **1.2 CONSTRUCTION FACILITIES**

- A. Furnish temporary services and utilities, including use fees and operation costs for potable and non-potable water, lighting and power, and materials storage.
- B. Furnish temporary storage areas for supplies, materials, and equipment. Establish and maintain all necessary emergency measures and controls.
- C. Furnish personnel support facilities including sanitary facilities, drinking water, first aid supplies, and trash removal. Provide and maintain typical portable sanitation facilities commonly used at job sites.
- D. Do not park vehicles or equipment or store materials on private property without written permission from the property owner.
- E. Provide and maintain suitable temporary field office at the Site to serve as headquarters for CONTRACTOR. Maintain at the field office and have available at all times copies of all communications, drawings instructions, and Safety Data Sheets (SDS, formerly known as MSDS) pertinent to the performance of the Work. Locate temporary office facilities in the designated staging area or another location mutually agreed upon by ENGINEER and CONTRACTOR.
- F. Notices and information that are required to be posted and/or available in a location unlocked and available to all employees include, but are not limited, to the following:
  - 1. Wage rate information poster and appropriate wage rate determination.
  - 2. EEO is the Law poster.
  - 3. Dual Employment Notice poster.
  - 4. EEO Officer Letter of Appointment.
  - 5. EEO Policy Statement.
  - 6. Discrimination complaint procedures.
  - 7. Discrimination complaint form.
- G. Provide and maintain a separate lockable and secure office and sanitation facility, located proximate to CONTRACTOR's facility within the staging area for use only by OWNER and ENGINEER. The office facility shall have a minimum of 200 square feet of usable space, heat, electricity and be properly lit to facilitate computer operations, paperwork, and plan review. Providing and maintaining the field office includes the cost of all utilities, including internet service with minimum speed of 0.5 megabits per second (Mbps). This field office, equipped as specified, shall be available at the Site for use by OWNER and ENGINEER prior to the start of any field work under the Contract.

### 1.3 SECURITY

Provide and maintain fencing, barricades, warning signs, and lights to secure all Work areas, equipment, and materials.

## **PART 2 PRODUCTS**

NOT USED

## **PART 3 EXECUTION**

### 3.1 SITE CLEANUP

- A. Periodically during the course of the Work, or as requested by ENGINEER, remove and dispose of all surplus construction materials, trash, and debris and keep the Project area and public rights-of-way clean.
- B. Upon completion of the Work, remove all temporary construction facilities, debris, and unused materials provided for the Project, leaving the Project area in a neat and clean condition.
- C. Costs of all cleanup work shall be considered incidental to other items of Work and no additional compensation will be allowed. All trash and debris shall be disposed of in a state licensed solid waste management facility.

### 3.2 RESTORATION OF AREAS DISTURBED BY CONTRACTOR

- A. Repair all property damage caused by CONTRACTOR at no additional expense to OWNER.
- B. Restore all disturbed areas outside of designated Work areas by grading to the original contours and as shown on the Drawings, placing topsoil on disturbed areas, and reseeding all disturbed areas as approved by ENGINEER. The cost for this work is incidental and no additional or separate payment will be made.



## SECTION 01570

### TEMPORARY TRAFFIC CONTROL

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section covers all labor, supplies, materials, equipment, and incidentals necessary for traffic control consisting of furnishing, installing, maintaining, and relocating traffic signs, barricades, lights, signals, pavement markings, and other traffic control devices necessary to ensure the safety of the general public and Project personnel in compliance with the Contract Documents. Work shall include flagging for the guidance of traffic through the Site and for public roadways.

##### 1.2 REFERENCES

Publications listed below are incorporated into this specification by reference.

**American Association of State Highway and Transportation Officials (AASHTO)**

The Green Book                                      A Policy on Geometric Design of Highways and Streets, 6<sup>th</sup> Edition

**Idaho Transportation Department (ITD)**

ITD Standard Specifications                      Standard Specifications for Highway Construction

**U.S. Federal Highway Administration (FHWA)**

MUTCD    Manual on Uniform Traffic Control Devices for Streets and Highways

##### 1.3 SUBMITTALS

**Traffic Control Plan**

Prepare and submit a Traffic Control Plan for any Work involving public roadways no later than 10 days prior to the start of Work. The Traffic Control Plan will be subject to review and approval by ITD for roads under their jurisdiction, by the appropriate county for roads under county jurisdiction, and by any other public entity having jurisdiction over other public roadways (e.g., U.S. Forest Service, city, etc.). These approvals will be in addition to that provided by ENGINEER in accordance with SECTION 01300 Submittal Procedures. No Work may commence until all approvals of the Traffic Control Plan have been secured.

#### PART 2 PRODUCTS

##### 2.1 GENERAL

All traffic control devices and materials shall be in accordance with the most current edition of ITD Standard Specifications for Highway Construction and MUTCD for Streets and Highways.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Provide traffic control signage and flaggers as necessary to safely complete the Work while accommodating public traffic. Traffic control shall conform to the standards set forth in MUTCD, current edition.
- B. Schedule operations to minimize interruptions of the streets, roads, and highways involved and keep all roads, streets, and highways open during normal working hours during the Work unless otherwise required in the Special Provisions or the Drawings. Provide uninterrupted two-way traffic at all times during overnight and weekend periods.
- C. Schedule construction operations in a manner to ensure that: 1) the safety and convenience of motorists, bicyclists, and pedestrians, and the safety of all personnel, are adequately met at all times; and 2) the Project is completed in a manner most beneficial to the Project as a whole.
- D. Observe posted speed limits on the roads leading to the Site as well as all other public roadways. All vehicles used in the Work shall strictly comply with these limits. Observe legal and posted weight limits for roadways and bridges in all hauling activities.
- E. All construction and Project-related traffic shall come to a complete and full stop when exiting the Site and yield the right-of-way to traffic on the public roadways, unless flagging protection is approved and implemented.

### **3.2 TRAFFIC CONTROL PLAN**

- A. Prepare a Traffic Control Plan including, but not limited to, the following:
  - 1. Itemization of signs, including: type, size, shape, color, location, and MUTCD reference.
  - 2. Temporary pavement markings.
  - 3. Channelization (e.g., cones, barrels, barricades).
  - 4. Flagging, including personnel numbers, time on location, and location(s).
  - 5. Lighting.
  - 6. Communication.
  - 7. Road closures and time of road closures.
  - 8. Special traffic patterns (e.g., pilot cars, one-way traffic lanes, detours).
  - 9. Signs during non-work hours.
  - 10. Designated entrances to the Project area.
  - 11. Map and descriptions of the anticipated routes and dates of use.
  - 12. Description of the anticipated haul equipment.
  - 13. Description of rights-of-way for all traffic, including haul roads and public roads, loaded trucks, empty trucks, service vehicles, etc.
  - 14. Traffic control measures for all public roads, haul routes, and Site access points.
  - 15. Locations of all signs, markers, barricades, and other traffic control devices to be used.
  - 16. Routing of any detours required.

### 3.3 CONSTRUCTION REQUIREMENTS

- A. Provide traffic control in full compliance with MUTCD during materials hauling and equipment operation or transport along public roadways.
- B. Store or park construction equipment, vehicles, materials, and debris a minimum of 30 feet from the edge of the traveled way or behind guardrail. When it is not feasible to park equipment or store materials a minimum of 30 feet from the edge of the traveled way or behind guardrail, utilize adequate warning devices and protective measures.
- C. Maintain at least one-way traffic at all times with continuous passage for emergency vehicles from either direction.
- D. At the conclusion of daily construction activities, ensure that necessary traffic control measures remain in effect overnight and through the weekend, including barricades around any open excavations or other hazards.

### 3.4 TRAFFIC CONTROL DEVICES

- A. Before placement for any stage of construction, all traffic control devices required for that stage shall be on-hand at the Site. Properly place, install, and operate all traffic control devices necessary for construction. Obtain approval of the placement and operation from ENGINEER before starting construction.
- B. Properly maintain, clean, and operate traffic control devices during the entire length of use.
- C. Immediately remove all traffic devices no longer needed for traffic control.
- D. For operations completed in stages, place only signage applicable to the present stage of construction. Remove, turn, or cover with opaque material any signage not applicable to the existing conditions, during shutdowns longer than 2 hours, at night, or when not needed on weather days, holidays, and weekends so as not to be readable to oncoming traffic.
- E. Set, size, and locate signs in a manner that is visible to the equipment operators and other vehicles as necessary.
- F. All traffic control devices furnished by CONTRACTOR shall remain the property of CONTRACTOR. Repair or replace traffic control devices when damaged or destroyed by traffic or other activities, or when traffic control devices fail to function properly at no cost to OWNER.

## **SECTION 01600**

### **FIELD SURVEYING**

#### **PART 1 GENERAL**

##### **1.1 DESCRIPTION**

This section covers all labor, supplies, materials, equipment, and incidentals necessary to conduct surveys required to stake and layout the Work at the Site in compliance with the Contract Documents. ENGINEER or OWNER's surveyor will perform quantity surveys to verify the quantities of "as-built" construction for payment of completed Work.

#### **PART 2 PRODUCTS**

NOT USED

#### **PART 3 EXECUTION**

##### **3.1 GENERAL**

- A. Exercise care during the execution of the Work to minimize any disturbance to existing property and to the landscape in the areas surrounding the Site.
- B. Ensure survey crews limit their work to within the Project boundaries as defined in the Contract Documents, as staked by Surveyor, and as requested by ENGINEER.

##### **3.2 SURVEY WORK**

- A. ENGINEER will provide all primary control and establish control coordinates for the Work, as shown on the Drawings, with necessary benchmarks adjacent to the Work. ENGINEER will provide all horizontal and vertical controls on the Drawings.
- B. Develop all detailed surveys needed for the Work.
- C. Set any supplementary stakes necessary to control the Work and meet the accuracy requirements of the Contract Documents.
- D. Perform the Work by reference and control provided.
- E. Maintain in place all primary and other control coordinate stakes and benchmarks. Control that is carelessly or willfully destroyed or disturbed by CONTRACTOR will be reset by CONTRACTOR at no expense to OWNER.
- F. Notify ENGINEER of any required survey at least 48 hours before starting the Work.

##### **3.3 SURVEY REFERENCE POINTS AND PROPERTY CORNERS**

- A. Protect all U.S. Geological Survey (USGS), Idaho Transportation Department (ITD) and OWNER survey benchmarks from damage. Damage to benchmarks shall be repaired by CONTRACTOR at no additional cost to OWNER.
- B. Identify and protect all existing survey control points and monuments prior to starting Work and preserve permanent control points during construction. Do not relocate Site control points without prior written approval from ENGINEER.

- C. Promptly report to ENGINEER the loss, damage, destruction, or relocation of any other control points or property corners due to changes in grades or other reasons. Survey accuracy used to relocate disturbed control points shall be equal to or better than that with which the original control was set. At a minimum, control points shall be reset to within the tolerance described in Subsection 3.5 of this specification.
- D. Install permanent reference points and re-establish property corners to meet the applicable laws.

### 3.4 INSPECTION AND INITIAL SURVEY

- A. Verify existing Site conditions including, but not limited to, locations and horizontal and vertical coordinates of existing bench marks, survey control points, utilities, topography, and Site features, prior to the start of the Work. Promptly notify ENGINEER of any discrepancies.
- B. Verify layouts periodically during the Work.
- C. Perform a damage inspection prior to the start of the Work, including all structures and identified aboveground utilities within the Site limits. Compare damage inspection results to the Site conditions indicated on the Drawings. Note any discrepancies in existing Site conditions, damage to existing facilities, or missing items and provide in writing to ENGINEER prior to the start of the Work.

### 3.5 SURVEY REQUIREMENTS

- A. All surveys to re-establish control surveys for elevation shall be  $\pm 0.01$  foot and for horizontal control angles shall be to the nearest 20 seconds  $\pm 10$  seconds. Measured distances shall be to  $\pm 0.01$  foot.
- B. All measurement surveys for elevation shall be to the nearest 0.01 foot and for horizontal distances shall be to  $\pm 0.01$  foot for monuments and  $\pm 0.1$  foot for ground shots.
- C. Provide all materials as required to properly re-establish control points and property monuments, including, but not limited to, instruments, tapes, rods, measures, mounts and tripods, stakes and hubs, nails, ribbons, other reference markers, and all other materials as required. All material shall be of professional quality and in good condition.
- D. If CONTRACTOR utilizes Global Positioning System (GPS) controlled equipment, provide all supplemental controls necessary. Coordinate with ENGINEER to incorporate any necessary field adjustments or overrides into the Work that cannot reasonably be represented in the design or GPS surfaces.

### 3.6 SURVEY RECORDS

- A. CONTRACTOR shall furnish to ENGINEER copies of all survey information monthly or as requested by ENGINEER.
- B. Upon request at the completion of all Work, ENGINEER will furnish CONTRACTOR copies of all field notes, computations, and survey information.

**SECTION 01700**  
**CONTRACT CLOSEOUT**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

This section covers requirements for the Contract closeout procedures.

**1.2 CLEANUP**

- A. Before Final inspection (as outlined in Paragraph 14.05 of the General Conditions) execute the following:
1. Complete all Work specified in the Contract Documents.
  2. Remove debris, waste, surplus materials, and rubbish from staging area, right-of-way, easements (construction or permanent), and private property.
  3. Clean traffic control devices and signs.
  4. Where applicable, remove all temporary traffic control measures.
  5. Sweep dirt and debris from all paved areas affected by the Work.
  6. Clean and restore public roads impacted by the Work.

**1.3 RECORD DOCUMENTS**

Submit record documents as outlined in the Contract Documents. Final payment will not be processed until the documents are submitted to and approved by ENGINEER.

**1.4 WARRANTIES AND BONDS**

Submit with Final Payment Request, all warranty certificates, lien releases, and consent of security forms.

**PART 2 PRODUCTS**

NOT USED

**PART 3 EXECUTION**

NOT USED

## **SECTION 02110**

### **MOBILIZATION AND DEMOBILIZATION**

#### **PART 1 GENERAL**

##### **1.1 DESCRIPTION**

This section covers all labor, supplies, materials, equipment, and incidentals necessary for mobilization and demobilization in compliance with the Contract Documents. Mobilization and demobilization consists of preparatory work and operations including, but not limited to, those necessary for the transportation and movement of personnel, equipment, supplies, and incidentals to the Site and removal from the Site of mobilized items upon Project completion.

#### **PART 2 PRODUCTS**

NOT USED

#### **PART 3 EXECUTION**

##### **3.1 GENERAL**

Provide safe storage for all equipment and materials intended for the Work until it has been incorporated in the completed Project. Locate storage areas at the staging areas or other areas approved by ENGINEER.

##### **3.2 WEED CONTROL**

- A. Comply with all provisions of the Weed Control Plan as described in SECTION 01310 ENVIRONMENTAL PROTECTION.
- B. Decontaminate all construction equipment to prevent the spread of noxious weeds by cleaning with high-pressure water before mobilizing equipment to or from the Site. Clean all wheels, tracks, undercarriages, fenders, blades, buckets, and the exterior body prior to entering or exiting the Site.
- C. Ensure all Subcontractors, suppliers, and vendors comply with all applicable portions of the Weed Control Plan.

##### **3.3 ADDITIONAL MOBILIZATION**

- A. Additional mobilization for work outside the scope of the Contract Documents shall be negotiated between CONTRACTOR and OWNER before any additional mobilization is made.
- B. Additional mobilization and demobilization for revegetation, seeding, warranty, and repair work is included in the Work and no separate or additional payment will be made.

##### **3.4 TEMPORARY FACILITIES**

- A. Mobilize and demobilize from the Site all temporary facilities shown on the Drawings, and as required in the Special Provisions and SECTION 01500 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.
- B. Mobilize and demobilize from the Site all other temporary facilities and equipment CONTRACTOR requires to complete the Work.

## SECTION 02120

### CLEARING AND GRUBBING

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section covers all labor, supplies, materials, equipment, and incidentals necessary for clearing, grubbing, removing, and otherwise disposing of vegetation and debris within the clearing limits at the Site in compliance with the Contract Documents. Vegetation and objects designated to remain on-Site shall be preserved free from damage, injury, and defacement.

##### 1.2 SUBMITTALS

###### Burn Permits

Submit state or county burn permits prior to on-Site burning.

##### 1.3 DEFINITIONS

###### 1.3.1 Clearing

Clearing is defined as the falling of trees and disposal of stumps, brush, windfalls, logs, limbs, sticks, piles of sawdust, rubbish, debris, vegetation, and other objectionable matter existing within the clearing limits or that interfere with excavation and embankment or other work. All areas within the neat lines of cut or fill areas or other clearing limits shown on the Drawings shall constitute the clearing limits.

###### 1.3.2 Grubbing

Grubbing is defined as the removal and disposal of roots, stumps, stubs, rock, debris, and other objectionable matter from the grubbing limits. All areas within the neat lines of cuts and all areas to be covered by embankments or other clearing limits shown on the Drawings shall constitute the grubbing limits.

###### 1.3.3 Clearing and Grubbing

Clearing and grubbing includes performing both clearing and grubbing as defined above.

###### 1.3.4 Disposal

Disposal is defined as removing, burning, burying, reusing, recycling, or otherwise disposing of the refuse accumulations from clearing, grubbing, or clearing and grubbing operations.

#### PART 2 PRODUCTS

NOT USED

#### PART 3 EXECUTION

##### 3.1 GENERAL

- A. Perform clearing, grubbing, or clearing and grubbing at times and in a manner that prevents damage to the surrounding vegetation, adjacent property, and items designated to remain on-Site. Sequence



operations to limit the cleared and grubbed area to the minimum necessary to complete the Work as specified. Confine dragging, piling, disposal of debris, and other work that may be injurious to vegetation to areas previously cleared and grubbed, areas with no vegetation, or areas that will be covered by embankments or disturbed by excavation.

- B. Preserve and protect from injury vegetation adjacent to streams, ponds, or lakes, unless the vegetation conflicts with the Work and is designated for removal in the Contract Documents. Replace to the satisfaction of ENGINEER, and at no cost to OWNER, any vegetation flagged or designated to be preserved that is damaged or destroyed by CONTRACTOR.
- C. Upon discovery of any evidence of archaeological, cultural, or historical activity or occupation, immediately stop Work and notify ENGINEER. ENGINEER will contact OWNER and proper authorities, if applicable, for assessment of the significance of the resource.
- D. Maintain trees, shrubbery, vines, plants, grasses, and other vegetation growing outside of the clearing limits free from injury. Paint all cut or scarred surfaces of trees or shrubs selected for retention with an approved asphaltum base paint prepared especially for tree surgery.
- E. Install all necessary erosion control measure before starting any clearing and grubbing activities in accordance with the Contract Documents. Maintain the erosion control measures throughout the Work.

### 3.2 CLEARING

- A. Cut off and dispose of all trees, stumps, brush, windfalls, logs, and other objectionable matter present within clearing limits, unless specifically flagged or designated to be saved.
- B. Cut all stumps within the clearing limits and cut all trees with stumps not to be grubbed, not more than the diameter of the stump and in no instance more than 12 inches above the ground.
- C. Stockpile woody materials for reuse in Site restoration and reclamation in accordance with the Contract Documents, and as requested by ENGINEER.

### 3.3 GRUBBING

Pull or otherwise remove to a depth of not less than 6 inches below the original ground surface all stumps, roots, logs, or other timber more than 3 inches in diameter, and all brush, matted roots, rock, and other debris within the grubbing limits not suitable for embankment foundation.

### 3.4 CLEARING AND GRUBBING

Perform clearing and grubbing in accordance with Subsections 3.2 and 3.3 above.

### 3.5 DISPOSAL OF MATERIALS

- A. Reuse logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations for erosion control, habitat restoration, and access prevention in accordance with the Contract Documents and as requested by ENGINEER.
- B. Dispose of all non-reusable refuse resulting from clearing and grubbing operations. Backfill with suitable material all depressions below subgrade or below the final surface of the ground resulting from the grubbing operations.
- C. Obtain state and county burn permits prior to on-Site burning of slash from clearing and grubbing operations. Meet all requirements of the burn permit including, but not limited to, the burning of only native debris and slash.
- D. In no case shall any material from clearing and grubbing operations be left on-Site, placed onto abutting properties, or buried in embankments, trenches, or repositories on-Site.

## SECTION 02130

### ROAD MAINTENANCE AND DUST CONTROL

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section covers all labor, supplies, materials, equipment, and incidentals necessary for the grading and maintenance of access roads, haul roads, and drainage ditches along all roads within the Site in compliance with the Contract Documents.

##### 1.2 REFERENCES

Publications listed below are incorporated into this specification by reference.

##### **American Society for Testing and Materials International (ASTM)**

ASTM D345	Standard Test Method for Sampling and Testing Calcium Chloride for Roads and Structural Applications
ASTM E449	Standard Test Methods for Analysis of Calcium Chloride

##### 1.3 SUBMITTALS

##### **Liquid Magnesium Chloride Analysis**

Submit physical and analytical characteristics of liquid magnesium chloride to be used on-Site and certificates showing guaranteed analysis in accordance with ASTM D345 and ASTM E449.

#### PART 2 PRODUCTS

##### 2.1 WATER

Provide water for dust control in accordance with SECTION 02140 PROVIDE WATER.

##### 2.2 LIQUID MAGNESIUM CHLORIDE

Provide liquid magnesium chloride for dust suppression meeting the following requirements:

Magnesium Chloride ( $\text{MgCl}_2$ ) Content:	Min. 30.0%
Sulfate ( $\text{SO}_4$ ) Content:	Max. 2%
Specific Gravity:	1.31 +/- 0.02

#### PART 3 EXECUTION

##### 3.1 WATER APPLICATION

- A. Apply water as needed to control dust from construction traffic within the Site as shown on the Drawings and as required in the Wind Erosion/Dust Control Plan. Apply water to unpaved roads or

other areas on-Site requiring dust control by water truck at a rate and frequency that controls all visible dust and does not produce sheet flow and/or erode existing features.

- B. Apply water during the course of the Work on an as-needed basis or as requested by ENGINEER.

### 3.2 LIQUID MAGNESIUM CHLORIDE APPLICATION

- A. Complete road maintenance and regrading to an acceptable road surface, as requested by ENGINEER, prior to application of liquid magnesium chloride.
- B. Apply liquid magnesium chloride to pre-watered and regraded roads requiring dust control by water truck or other ENGINEER approved application equipment.
- C. Apply liquid magnesium chloride at an application rate of 0.5 gallons per square yard (split in two 0.25 gallons per square yard applications).

### 3.3 ROAD MAINTENANCE

- A. Regrade, repair and/or resurface all roads receiving Project-related traffic within the Site as described in the Contract Documents, and as requested by ENGINEER.
- B. Regrade roads using appropriately sized grader.
- C. Apply water to the road as necessary during regrading and as requested by ENGINEER.
- D. Regrade roads to meet the surface smoothness requirements in SECTION 802 CRUSHED AGGREGATES (Idaho Standards for Public Works Construction).

## **SECTION 02140**

### **PROVIDE WATER**

#### **PART 1 GENERAL**

##### **1.1 DESCRIPTION**

This section covers all labor, supplies, materials, equipment, and incidentals necessary for furnishing, distributing and applying water required for the Work including, but not limited to, compaction, revegetation, fire control, and dust control at the Site in compliance with the Contract Documents.

#### **PART 2 PRODUCTS**

##### **2.1 WATER**

- A. Water shall be clean and free from harmful amounts of oils, acids, alkalis, salts, vegetated substances, and organic materials. Potable water is acceptable.
- B. CONTRACTOR shall obtain approval of water source from ENGINEER prior to use.

#### **PART 3 EXECUTION**

##### **3.1 GENERAL**

- A. Locate a water source and furnish water for specified Work. Obtain any necessary water rights and/or permits. Water source must be approved by ENGINEER prior to use.
- B. Maintain records of water withdrawal and use as required by applicable permits or the Contract Documents.
- C. Establish all necessary water loading areas. Construct the water loading areas in locations approved by ENGINEER.
- D. Install all necessary Best Management Practices (BMPs) to protect adjacent water bodies and as requested by ENGINEER.
- E. Establish and observe all temporary traffic control and conventions as required in the approved Traffic Control and Transportation Plans.

##### **3.2 EQUIPMENT**

- A. Provide all necessary, fully-functioning pumping equipment, piping, tanks, water trucks, and measuring devices for acquisition and application of water. Water trucks shall be equipped with a spray bar of adequate capacity and design to ensure uniform application of water in the amounts designated. CONTRACTOR shall obtain approval of measuring devices from ENGINEER.
- B. Install screens on inlet hoses to prevent drawing fish and other aquatic species into piping.
- C. Provide equipment for fire control and extinguishing burning waste piles capable of providing a minimum of 100 gallons per minute of water at sufficient pressure to successfully accomplish the work. Provide all runpumps, nozzles, valves, hoses and connections necessary for fire control.

### 3.3 APPLICATION

- A. Apply water to all areas necessary or as requested by ENGINEER in a manner required to properly complete the Work.
- B. Apply water as needed to obtain the optimum moisture content specified for compaction.
- C. Apply water as requested by ENGINEER for dust control on roads, disturbance areas, or seeded areas. Apply water for dust control immediately upon request by ENGINEER.
- D. Apply water for washing public road entrances as required in the Contract Documents or as requested by ENGINEER.
- E. Provide water for decontamination stations or wheel washing areas as required or as requested by ENGINEER.

## SECTION 02150

### EROSION AND SEDIMENT CONTROL

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section includes all labor, supplies, materials, equipment, and incidentals necessary for planning, permitting, scheduling, furnishing, installing, maintaining and removing soil surface erosion and sediment control materials, and implementing Best Management Practices (BMPs) to prevent water pollution, and control sediment transport and soil erosion at the Site in compliance with the Contract Documents.

##### 1.2 REFERENCES

Publications listed below are incorporated into this specification by reference.

**Idaho Department of Environmental Quality (DEQ)**

Catalog of Stormwater Best Management Practices for Idaho Cities and Counties

**Idaho Transportation Department (ITD)**

Best Management Practices (BMP) Manual

**U.S. Environmental Protection Agency (EPA)**

National Pollutant Discharge Elimination System (NPDES)

Construction Site Storm Water Runoff Control at <http://cfpub.epa.gov/npdes/stormwater/menuofbmps>

CWA, Section 402                      Section 402 of the Clean Water Act (CWA, Public Law 92-500, as amended)

##### 1.3 SUBMITTALS

Submit the following no later than 10 days prior to the start of Work or installation.

**Manufacturer's Information**

Submit Manufacturer's catalog cut, material specifications, application, and installation instructions for all materials to be used.

**List of equipment to be used for the application of erosion control materials.**

**Erosion Control Material Samples**

Submit the following material samples to ENGINEER for approval:

1. Two (2) pounds of hydraulic mulch.
2. One 6-inch square of each geotextile fabric.
3. One 12-inch square of each type of mat.
4. One sample staple.

**Mulch Certification**

Submit certification that the material furnished has been laboratory and field tested and that it meets requirements and intents specified. All mulch material must be approved by ENGINEER.

**National Pollutant Discharge Elimination System (NPDES) Permit and Notice of Intent (NOI)**  
**(If required)**

**Storm Water Pollution Prevention Plan (SWPPP)**

**Application for Beneficial Water Use Permit (Form 600)**

**Housekeeping Plan**

Submit a detailed written plan for implementation of housekeeping requirements. Provide for the entire Site including structures and access ways.

**Wind Erosion/Dust Control Plan**

**Other Possible Permits**

Comply with all other applicable regulations and permit requirements.

**PART 2 PRODUCTS**

**2.1 EROSION CONTROL MAT**

- A. Erosion control mat (or erosion control blanket) shall be straw, straw/coconut or coconut with photodegradable extruded plastic mesh or woven jute fabric. Turf reinforcement mat shall be ultraviolet (UV)-stabilized woven permanent products.
- B. Provide erosion control mat of the type and grade (model) specified in the Contract Documents or as requested by ENGINEER.
- C. Provide erosion control mats in continuous rolls of 30-feet or greater with a minimum width of 4 feet.
- D. Wire staples shall be 0.091-inch in diameter or greater and have a "U" shape with legs 6- to 8-inches in length, with a 1- to 2-inch crown. For slopes steeper than 3:1 (horizontal:vertical), use staples with a minimum length of 8 inches.
- E. Biodegradable stakes shall be T-shaped and a minimum of 6 inches in length.
- F. Manufacturer's recommended staple types and dimensions may be acceptable if approved by ENGINEER. In all cases, staples shall be of sufficient length to properly secure erosion control materials to the subgrade below the growth media layer.

**2.2 MULCH**

- A. Provide vegetative mulch, wood fiber mulch or other much specified in the Contract Documents or approved by ENGINEER.
- B. Mulch material is not acceptable if it is musty, moldy or rotted, or if it contains seed bearing stalks or noxious weeds. Mulch shall be free of stones, dirt, roots, stumps and other foreign material.

**2.2.1 Vegetative Mulch**

- A. Vegetative mulch material shall be composed of wheat straw, barley straw, grass hay, or rye straw, in that order of preference.
- B. Vegetative mulch material shall be composed of stems at least 10 inches long. Grass hay mulch shall contain greater than 70% grass by weight and shall not contain greater than 10% alfalfa, or crested wheatgrass, subject to ENGINEER approval. Grass hay must be certified Noxious Weed Free Forage and Straw and provided by a certified supplier.
- C. Chopped or ground material is not acceptable.

### 2.2.2 Straw Mulch

- A. Straw mulch material shall be clean grain straw, at least 10 inches long, and shall not contain greater than 5% cereal seed by weight (seed heads).
- B. Use only certified Noxious Weed Free Forage and Straw from a certified supplier.

### 2.2.3 Wood Fiber Mulch

- A. Wood fiber mulch shall consist of specially prepared wood fibers, processed in such a manner that it will not contain any growth or germination inhibiting factors. Fiber shall not be produced from recycled material such as sawdust, paper, cardboard, or residue from pulp and paper plants.
- B. Fiber shall be dyed an appropriate color to facilitate visual metering during application and supplied in packages marked by the manufacturer to show the air dry weight content.
- C. Mulch shall be of a consistency such that the fibers in the material will be uniformly suspended and form a homogeneous slurry after being combined in a slurry tank with water, dye and other approved additives. During application, the material shall produce a mat-like net covering the grass seed.
- D. Add a nontoxic water-soluble green colored dye to the water to facilitate visual metering during application.

### 2.2.4 Organic Mulch

- A. Organic mulch shall be a neutral pH organic product formulated from grass/straw byproducts specifically processed for mulching purposes. Organic mulch shall not contain stalks or seeds of noxious weeds or grasses, or any growth or germination inhibiting factors.
- B. The mulch shall be supplied in packages marked by the manufacturer to show the air dry weight content.
- C. Organic mulch shall be of a consistency such that the fibers in the material will be uniformly suspended and form a homogeneous slurry after being combined in a slurry tank with water, dye and other approved additives. During application, the material shall produce a mat-like net covering the grass seed.
- D. Add a nontoxic water-soluble green colored dye to the water to facilitate visual metering during application.

### 2.2.5 Hydraulic Mulch

- A. Tackifier shall be a biodegradable organic formulation processed specifically for the adhesive binding of mulch. Organic soil and mulch tackifier for use in hydraulically planting of grass seeds, flowers, or woody tree seeds, or stolon, either alone or in combination with fertilizer, wood fiber mulch, and other approved additives, shall consist of specifically blended compatible hydrocolloids. Starch-based tackifiers will be rejected.
- B. Supply soil and mulch tackifier in packages containing 5, 20, or 40 pounds of material having an equilibrium air dry moisture content at time of manufacture of 8% ( $\pm 2\%$ ), and a minimum water holding capacity of 6-1/2 times by weight of dry material.
- C. Tackifier shall uniformly disperse when mixed with water and not be detrimental to the homogeneous properties of the mulch slurry. Organic soil and mulch tackifier shall have the additional characteristics of hydrating and dispersing in circulating water to form a homogeneous slurry and remain in such a state in the hydraulic mulching unit, or adequate equal, with the specified, or other approved materials.
- D. When applied, the organic soil and mulch tackifier shall form a loose chain-like protective film, but not a plant inhibiting membrane. This film will allow moisture to percolate into the underlying soil and help "stick" seeds, fertilizer and other specified materials to the soil surface during germination and initial seedling growth, after which the organic soil and mulch tackifier will breakdown by microbial action.



- E. Any tackifier which has been damaged by moisture damaged or other means will not be acceptable. Tackifier may be added either during the manufacturing of the mulch or incorporated during mulch application. Dye shall be nontoxic, water-activated, green in color, and pre-packaged in water dissolvable packets in the hydraulic mulch.

### 2.3 RIPRAP

Refer to SECTION 02300 RIPRAP or the Contract Documents.

### 2.4 ROCK COVER

Refer to SECTION 02320 ROCK COVER or the Contract Documents.

### 2.5 STRAW WATTLES/FIBER ROLLS

Straw wattles shall be minimum 12-inch diameter tubes of 100% weed seed free agricultural straw wrapped in UV-stabilized synthetic net. Secure wattle ends with wire enclosures.

### 2.6 WIRE WRAPPED ROCK WATTLE AND CURB SOCKS

Rock used in wire wrapped wattles and curb socks shall be 1.5-inch crushed rock fill. Recycled asphalt and concrete are not acceptable.

### 2.7 GEOTEXTILE DEWATERING TUBES/BAGS

Geotextile Dewatering Tubes/Bags shall meet the minimum requirements specified in the Contract Documents.

### 2.8 FILTER FENCE

Refer to SECTION 02410 GEOTEXTILE or the Contract Documents.

### 2.9 GEOTEXTILES

Refer to SECTION 02410 GEOTEXTILE or the Contract Documents.

## **PART 3 EXECUTION**

### 3.1 DELIVERY, INSPECTION, STORAGE, AND HANDLING

- A. Store materials in designated areas as recommended by the manufacturer and in accordance with the Contract Documents. Protect all erosion and sediment control materials from the elements, direct exposure, and damage.
- B. Do not drop container or material from trucks.
- C. Material shall be free of defects that would void required performance or warranty.
- D. Furnish erosion control mat and fabric in rolls with suitable wrapping to protect against moisture and extended UV exposure prior to placement.
- E. Label rolls of erosion control mat and fabric rolls to provide identification sufficient for inventory and quality control purposes.

### 3.2 GENERAL

- A. Plan and sequence the Work in such a way to minimize the amount of disturbed, bare ground at any one time.
- B. Select and implement BMPs consistent with the reference guidance documents. Install or implement BMPs at the locations shown on the Drawings, as requested by ENGINEER, and according to CONTRACTOR's Erosion and Sediment Control Plan.
- C. Install or implement all required BMPs before starting any stripping, clearing, or grubbing.
- D. To the extent practical protect and preserve existing vegetation. Do not strip areas until it is necessary to do so and strip only the area necessary to complete the Work as specified. Preserve buffer vegetation throughout the Project.
- E. Perform erosion control operations under favorable weather conditions. When excessive moisture, frozen ground, or other unsatisfactory conditions prevail, the Work may be stopped as requested by ENGINEER.

### 3.3 WIND EROSION CONTROL

- A. CONTRACTOR shall be responsible for dust control during the Work. CONTRACTOR shall water or otherwise treat dust-generating surfaces (including roads, staging area(s), excavation, stockpile and waste placement areas) as often as necessary to comply with all federal and state standards for airborne particulates and as requested by ENGINEER.
- B. Prior to commencing any Work, CONTRACTOR shall submit a Wind Erosion/Dust Control Plan including, but not limited, to the following:
  - 1. Times and nature of dust generating activity on public roads or at the Project area.
  - 2. Nature of dust abatement measures to be used (e.g., watering or application of chemical treatment).
  - 3. Source of water.
  - 4. Methods of application of dust control measures.
  - 5. Time schedule for application of dust control measures.
  - 6. Procedures and availability of equipment to address dust control at other than scheduled times, if necessary.
  - 7. Name and contact information of an individual who is available at all times to address dust control issues. The individual shall be responsive to problems within 1 hour or less. If this person cannot be contacted, OWNER may at CONTRACTOR expense, perform the dust control work or contract out the dust control work.
- C. Damages resulting from dust originating from CONTRACTOR operations are the sole responsibility of CONTRACTOR.
- D. ENGINEER may stop any Work contributing to air pollutant levels which are excessive or in violation of federal, state, or local laws. Additional expenses resulting from the Work stoppage will be the responsibility of CONTRACTOR.
- E. Utilize such methods and devices as are reasonably available to prevent, control, and otherwise minimize atmospheric emissions or discharges of air contaminants.
- F. Prevent, control, and abate dust pollution on right-of-ways or elsewhere during performance of the Work. Provide labor, equipment, and materials, and use efficient methods wherever and whenever required to prevent dust nuisance or damage to: crops, orchards, cultivated fields, wildlife habitats, dwellings and residences, agricultural activities, recreational activities, traffic, and similar conditions.

- G. Provide means for eliminating atmospheric discharges or dust during mixing, handling, and storing of lime, cement, pozzolan, and concrete aggregate.
- H. Apply water to Work areas, stockpiles, staging areas roads, etc., as requested by ENGINEER to control dust.
- I. Suspend Work in excessively dry and windy conditions that make dust control impractical or overly difficult. Suspension of Work for dust control purposes will be considered as weather days in accordance with the Contract Documents.

### 3.4 INSTALLATION

Install BMPs at the locations shown on the Drawings or as requested by ENGINEER, and according to CONTRACTOR's Wind Erosion/Dust Control Plan, the Contract Documents, and manufacturer's recommendations.

#### 3.4.1 Surface Roughening

Rip, disk, track, and scarify surfaces as requested by ENGINEER in such a manner that furrows and terraces are constructed perpendicular to flow.

#### 3.4.2 Diversion Ditches

Construct diversion ditches with rounded or flat bottoms with positive drainage and include a well-defined destination such as a sediment trap or expansive vegetated area.

#### 3.4.3 Check Dams

Utilize rock size and gradation as specified in SECTION 02320 ROCK COVER, unless otherwise specified in the Contract Documents. Construct check dams to the details, dimensions, and spacing shown on the Drawings.

#### 3.4.4 Straw Wattles

Install wattles along contours in accordance with manufacturer's recommendations and as shown on the Drawings. Stake wattles with 18- to 24-inch wood stakes at 4-foot centers unless otherwise specified.

#### 3.4.5 Erosion Control Mat

- A. After completion of fertilizing and seeding, install erosion control mats in the areas specified. Erosion control mat locations may be adjusted to meet field conditions as requested by ENGINEER.
- B. Place the finer mesh size side or fiber side of the mat in contact with the soil (not applicable to woven jute fabric). Loosely lay the mat on the soil surface without stretching to achieve maximum contact with the soil.
- C. Install erosion control in vertical strips and anchor with staples driven into the ground for the full length of the staple legs. Abut adjacent strips to allow for installation of a common row of stakes and stagger end joints. Overlap horizontal joints between erosion control mats sufficiently to accommodate a common row of stakes with the uphill end on top. On slopes, install mat perpendicular to the slope and trench in at the uphill end of the mat as shown on the Drawings and according to the manufacturer's recommendations, stapling on 2-foot centers in the trench bottom. Additional trenching and backfilling of mat may be required to ensure adequate stability.
- D. Where erosion control mat will be exposed to overland sheet flow, locate a trench at the uphill termination and stake to the bottom of the trench. Backfill and compact the trench.
- E. Where terminating in a channel containing an installed mat, the erosion control mat shall overlap installed mat sufficiently to accommodate a common row of stakes.

- F. Install the mat after seeding in a manner as to not seriously disturb the seedbed surface. If the seedbed is seriously disturbed, repair the seedbed and reseed as requested by ENGINEER at no additional cost to OWNER.

#### 3.4.6 Mulch

- A. Apply mulch to specified areas or as requested by ENGINEER. Mulch seeded areas not more than 24 hours after seeding, regardless of the type of mulch used. If seeded areas are not mulched within 24 hours after seeding, reseed the area at the request of ENGINEER at no additional cost to OWNER. Mulch may be applied to damp ground, but not in areas of free surface water or to snow covered ground surfaces.
- B. Do not apply mulch to areas having a substantial vegetative growth, as determined by ENGINEER.
- C. Remove any equipment tracks on the seedbed prior to final mulching, using a rake, small harrow, or other acceptable means.
- D. When asphalt or a tackifying agent is used as a binder for vegetative mulch, evenly distribute over the vegetative material as it emerges from the blower discharge or hydraulically apply directly following mulch application. Correct uneven distribution, caused by inadequately powered or improperly adjusted equipment, poor workmanship, erratic material feed or discharge, or similar causes. The quantity of asphalt or tackifying agent specified is subject to increase or decrease as determined in the field by ENGINEER.
- E. Protect all roadway structures and facilities from application of bituminous material. Remove any bituminous material deposited on structures or facilities, roadways, or as requested by ENGINEER at no additional cost to OWNER.
- F. Spread straw or native hay at the rate specified and anchor straw or hay into the seedbed by using a mulch crimper. Straw or hay shall have a minimum length of 10 inches long and shall be pliable. If straw breaks during crimping, sprinkle straw with water, but do not soak to facilitate placement.
- G. Use a mulch crimper specifically designed for this purpose with round, flat (not angled), notched blades approximately 0.25-inch thick by 18 inches in diameter and spaced 8 inches apart. Crimper shall have sufficient weight to force the vegetative mulch a minimum of 3 inches into the soil and equipped with disc scrapers. Crimp mulch on all slopes capable of being safely traversed by a tracked vehicle, perpendicular to the flow line of the slope.

#### 3.4.7 Application of Hydraulic Mulch

- A. Apply a minimum of 2,000 pounds of wood cellulose fiber or straw mulch per acre on slopes less than 3:1 (horizontal:vertical) and 4,000 pounds of wood cellulose fiber or straw mulch per acre on slopes steeper than 3:1 (horizontal:vertical).
- B. Apply soil and mulch tackifier at a minimum rate of 40 pounds per acre on slopes 2:1 (horizontal:vertical) or flatter, at 80 pounds per acre or more on slopes steeper than 2:1 (horizontal:vertical), or at manufacturer's recommendations and approved by ENGINEER.
- C. Apply organic mulch by means of hydraulic equipment which utilizes water as the carrying agent. Maintain a continuous agitator action, keeping the mulching material and approved additives in uniform suspension throughout the distribution cycle. Use pump pressure capable of maintaining a continuous non-fluctuating stream of slurry and slurry distribution lines large enough to prevent stoppage.
- D. Equip the discharge line with a set of hydraulic spray nozzles to provide an even distribution of the mulch slurry to the seedbed. Mulch may be applied to damp ground, but not in areas of free surface water or to snow covered ground surfaces. Do not apply mulch to areas having a substantial vegetative growth, such as grasses, weeds, and grains.
- E. Start at the top of the slope and work downward. If necessary, use extension hoses to reach the extremities of slopes.

- F. Prior to final acceptance of the Work, immediately remulch any area from which the original mulch is washed or blown away. If the original seedbed and seeding is damaged due to the displacement of the mulching material, repair and reseed before remulching. Repair areas requiring reseeding and remulching as the result of CONTRACTOR negligence at no additional cost to OWNER.

#### 3.4.8 Coir

Refer to SECTION 02930 NEW STREAM CHANNEL CONSTRUCTION, the Contract Documents, or manufacturer's recommendation for installation of coir fabric.

#### 3.4.9 Riprap

Refer to SECTION 02300 RIPRAP or the Contract Documents.

#### 3.4.10 Filter Fence

Refer to SECTION 02410 GEOTEXTILE, the Contract Documents, or manufacturer's recommendation for installation of filter fence.

#### 3.4.11 Straw Wattles/Straw Rolls

Install as shown on the Drawings, according to the Contract Documents, or manufacturer's recommendations.

#### 3.4.12 Wire Wrapped Rock Wattles and Curb Socks

Install as shown on the Drawings, according to the Contract Documents, or manufacturer's recommendations.

#### 3.4.13 Geotextile Dewatering Tubes/Bags

- A. Install as shown on the Drawings, according to the Contract Documents, or manufacturer's recommendations
- B. Once the tubes/bags are full they shall be given sufficient time to dry and the contents disposed of in an area where the silt will not return to the stream during a rainfall event or as requested by ENGINEER.
- C. If tubes/bags are full of sediment from mine-impacted removal areas, dispose of the sediment with other impacted materials from the Project.

### 3.5 SUMMER EROSION CONTROL MEASURES

- A. Implement summer erosion control measures for slopes and areas finished after the spring seeding period and prior to the fall seeding period. Plan and sequence the Work to minimize slopes and areas that would require summer erosion control measures.
- B. Apply and crimp approved straw mulch at a minimum application of 5,000 pounds per acre.
- C. Track/walk slopes to create roughness.
- D. Install straw wattles, silt fences, run-on control ditches, etc., as requested by ENGINEER.
- E. No separate or additional payment for implementing the summer erosion control measures will be made.

### 3.6 MAINTENANCE, PROVISIONAL, AND FINAL ACCEPTANCE

#### 3.6.1 Maintenance and Provisional Acceptance

- A. Provide against washouts on slopes with methods approved by ENGINEER. Regrade any washout that occurs until a good stand of grass is established at no additional cost to OWNER.

- B. Clean, maintain, and repair all structural BMPs as needed or as requested by ENGINEER. Conduct routine maintenance of all structural BMPs to ensure proper functionality compliance with the Contract Documents. At least once each day, inspect all areas of Work and record the findings recorded on the Quality Control Daily Report in accordance with SECTION 01400 CONTRACTOR QUALITY CONTROL. CONTRACTOR shall take immediate action to correct any issues and ensure compliance.
- C. ENGINEER will inspect all erosion and sediment control work at the completion of the construction for provisional acceptance. Maintain all erosion and sediment control work during the construction and warranty period for the Project.
- D. Furnish full and complete written instructions and schedule for maintenance of the erosion and sediment control measures to ENGINEER prior to and at the completion of construction. Inspections by ENGINEER will determine whether maintenance is required more or less frequently than CONTRACTOR's provided maintenance schedule.
- E. After all necessary corrective work and cleanup has been completed and ENGINEER has received the maintenance instructions and schedules, ENGINEER will certify in writing the provisional acceptance of the erosion and sediment control measures.

### 3.6.2 Final Acceptance

- A. All erosion and sediment control measures shall be maintained and guaranteed for not less than 1 full year from the time of acceptance.
- B. At the end of the warranty period, inspection will be made by ENGINEER upon written request submitted at least 10 days before the anticipated date. Repair, replace, and maintain any areas not demonstrating satisfactory effectiveness as requested by ENGINEER
- C. After all necessary corrective work has been completed, ENGINEER will certify in writing the final acceptance.

## SECTION 02210

### EARTHWORK

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section covers all labor, supplies, materials, equipment, and incidentals necessary for general excavation and backfilling of embankments, roadways, structures, ditches or channels, drainage features, repositories, waste consolidation areas, mine wastes, and general unclassified excavations in compliance with the Contract Documents. Work also includes all necessary stockpiling, backfill, subgrade preparation, compaction, final grading, dressing, and cleanup of the Site.

##### 1.2 SUBMITTALS

###### Excavation Plan

Prepare and submit an Excavation Plan for approval by ENGINEER no later than 10 days prior to the start of any Work requiring earthwork. Include proposed methods, equipment, coordination with other Work items, materials delivery, sequencing, and scheduling of the Work.

###### Backfill Analysis

Submit test results, including source location, gradation, and moisture-density characteristics, of all materials from on-Site and off-Site sources for approval by ENGINEER prior to placing the material or delivering the material to the Site.

##### 1.3 REFERENCES

Publications listed below are incorporated into this specification by reference.

###### **American Association of State Highway and Transportation Officials (AASHTO)**

AASHTO HB-17	Standard Specifications for Highway Bridges, 17th Edition
AASHTO T89	Standard Method of Test for Determining the Liquid Limit of Soils
AASHTO T90	Standard Method of Test for Determining the Plastic Limit and Plasticity Index of Soils
AASHTO T99	Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

###### **American Society for Testing and Materials International (ASTM)**

ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

**Code of Federal Regulations (CFR), U.S. Environmental Protection Agency (EPA)**

29 CFR 1926.651                      Specific Excavation Requirements

**U.S. Federal Highway Administration (FHWA)**

MUTCD                                  Manual on Uniform Traffic Control Devices for Streets and Highways

**1.4      DEFINITIONS**

**1.4.1    Excavation**

Excavation is defined as performing all operations necessary to excavate, grade, and handle all materials encountered during excavation at the areas designated on the Drawings. Work includes roadway excavation, structure excavation, channel excavation, unclassified excavation, repositories, mine wastes, waste consolidation areas, and all other excavation not specifically covered under other Technical Specifications.

**1.4.2    Embankment**

Embankment is defined as performing all operations necessary to prepare, backfill, compact, and grade all areas requiring embankment or fill as shown on the Drawings. Work includes roadway embankment, structure embankment, dike embankment, backfilling mine workings and depressions, cut and fill terracing, placing materials in repositories or waste consolidation areas, and all other forms of backfilling or embankment not specifically covered under other Technical Specifications.

**1.4.3    Stripping and Stockpiling**

Stripping includes stripping and stockpiling the topsoil to full depth at the existing surfacing and in accordance with SECTION 02900 GROWTH MEDIA (COVER SOIL). Stockpile and replace the stripped topsoil over the excavation or other specific areas shown on the Drawings after backfilling is complete.

**PART 2    PRODUCTS**

**2.1      ON-SITE AND IMPORTED MATERIALS**

Suitable materials for embankment and backfill are those materials classified in ASTM D2487 or as specified, and free from roots and other organic matter, timbers, tree trunks and branches, concrete debris, frozen materials, stones larger than 6 inches in any dimension, and other deleterious materials that will prevent proper placement and compaction.

**2.2      ROADWAY MATERIALS**

Requirements for roadway materials are specified in Idaho Standards for Public Works Construction SECTION 801 UNCRUSHED AGGREGATES and SECTION 802 CRUSHED AGGREGATES. Prepare and compact subgrade as described in SECTION 202 EXCAVATION AND EMBANKMENT.

**PART 3    EXECUTION**

**3.1      GENERAL**

- A. All excavation and embankment is considered unclassified and includes the removal and proper handling of any and all material encountered regardless of type or nature obtained within the construction limits.
- B. Use all suitable materials removed from excavation for backfill and in embankments.



- C. Dispose of all non-suitable materials in accordance with the SECTION 02213 DEBRIS AND STRUCTURE DISPOSAL or as otherwise approved by ENGINEER.
- D. Reclaim all areas disturbed during earthwork.

### 3.2 EXCAVATION PLAN

- A. Prepare and submit an Excavation Plan including, but not limited to the following:
  - 1. CONTRACTOR's approach to completing all necessary earthwork.
  - 2. Excavation sequence.
  - 3. Dewatering issues and approach to removing wet or difficult materials.
  - 4. Dewatering, water management, and sediment controls.
  - 5. Geotechnical safety concerns and remedies.
  - 6. Trench sloping, shoring, and bracing plan.
  - 7. Any other information relevant to completing the Work.

### 3.3 SITE PREPARATION

- A. Clear and grub all areas scheduled for excavation and embankment in accordance with SECTION 02120 CLEARING AND GRUBBING and SECTION 02213 DEBRIS AND STRUCTURE DISPOSAL.
- B. Salvage and stockpile all suitable topsoil and subsoil in the scheduled Work areas prior to excavation and embankment work in accordance with SECTION 02900 GROWTH MEDIA (COVER SOIL).

### 3.4 LINE AND GRADE CONTROL

- A. Perform all necessary surveys for control of line and grade using the established project survey control monuments for reference throughout the Project in accordance with SECTION 01600 FIELD SURVEYING.
- B. Establish and maintain throughout the Work, all survey control necessary to support CONTRACTOR operations.

### 3.5 EXCAVATION

#### 3.5.1 General

- A. Locate all utilities before starting the Work. Notify ENGINEER immediately if unmarked or unknown utilities are encountered during excavation.
- B. Utilize equipment and excavation methods appropriate for the Work to provide finished Work meeting all specified construction tolerances. Do not perform any Work beyond the construction or disturbance limits shown on the Drawings without prior written approval from ENGINEER.

#### 3.5.2 Dewatering

Dewater excavations in accordance with SECTION 02214 DIVERSION AND DEWATERING.

#### 3.5.3 Sloping, Shoring, Sheet piling, and Bracing

- A. Slope the sides of all excavations over 5 feet deep in accordance with Occupational Safety and Health Administration (OSHA) regulations. Use approved supporting systems to retain the sides of

excavations greater than 5 feet deep, if sloping is not feasible. Protect sides of excavations less than 5 feet deep when hazardous ground movement is expected.

- B. Install all shoring, bracing, and tight sheeting required to prevent caving and to protect workers and adjacent property and structures in accordance with the OSHA requirements and SECTION 01320 SAFETY, HEALTH, AND EMERGENCY RESPONSE.
- C. Install and maintain all Work area access controls and perform housekeeping to prevent equipment, materials, and personnel from falling into an unmarked excavation.

#### 3.5.4 Surplus, Unsuitable, and Waste Material

- A. Where the ground foundation for embankments is composed of muck, waste, or other unsuitable material, remove all such materials to the depth specified or as determined in the field by ENGINEER. Backfill with suitable material all holes created during removal of soft or unsuitable material. Suitable backfill obtained from other areas of the excavation is "unclassified excavation", unless otherwise approved in writing by ENGINEER.
- B. When unsuitable material or debris is encountered during excavation, remove the material completely or over-excavate at least 1 foot below the specified grade. Place and compact suitable material to bring the area to grade.
- C. Use suitable surplus excavated material as embankment backfill where feasible. If not feasible, place or dispose of all excess excavated material not required or suitable for backfill at a location approved by ENGINEER.
- D. Dispose of all material not suitable for on-Site disposal in accordance with SECTION 02212 HAULING and SECTION 02213 DEBRIS AND STRUCTURE DISPOSAL.

#### 3.5.5 Maintenance of Subgrade and Drainage

- A. During excavation, ensure proper drainage of the subgrade at all times. Construct all side ditches emptying from cuts to embankments in a manner that prevents damage by erosion. Employ all necessary erosion and sediment control measures.
- B. If it is necessary in the action of the Work to interrupt existing surface drainage, provide and maintain temporary drainage facilities until permanent drainage facilities are completed. Take all necessary precautions to protect and preserve any and all existing subsurface drains, conduits, utilities, and other underground structures or parts thereof which may be affected by the Work. Repair all damage to facilities or structures caused by CONTRACTOR at no cost to OWNER.

#### 3.5.6 Structure Excavation

- A. Obtain authorization of ENGINEER prior to starting excavation adjacent to existing structures.
- B. Perform excavations for structures or structure footings to the specified lines, grades, and elevations. Adjust as necessary to ensure sufficient size to complete the Work. The bottom of the footing elevations shown on the Drawings are considered approximate. Notify ENGINEER when each excavation is complete. Do not install footings without first notifying ENGINEER.
- C. Do not disturb the bottom of the excavation more than necessary where concrete is to be placed. When the excavation is at the required depth, pump all water from the excavation and clear the foundation bed for inspection. Remove all loose and disintegrated rock and thin strata. Clean out and fill all seams or crevices in rock strata with concrete mortar. Remove soft or otherwise unsuitable foundation material and backfill with approved compacted, granular material.
- D. When foundation piles are used, complete the excavation of each pit before the piles are driven and place foundation backfill after the piles are driven. After the driving is completed, remove all loose and displaced material, leaving a smooth, solid bed to receive the footing.

## 3.6 EMBANKMENT

### 3.6.1 Foundation Preparation

- A. After stripping topsoil, scarify the surface to a depth of 6 inches. Water and compact all areas receiving fill in conjunction with the first lift of new fill.
- B. When embankments are to be placed on a hillside, or where new fill is to be placed against an existing embankment, bench or step the slope of the original hillside, or old fill, by cutting into it horizontally a minimum distance of 12 inches or two (2) times the largest size particle in the fill being placed, whichever is greater. Cut each bench as close to the one below it as the ground slope will permit to provide a secure bond between the new and existing materials.
- C. Incorporate suitable materials cut out of the benches into the new fill.

### 3.6.2 Placement

- A. Install embankment and backfill materials after the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by ENGINEER.
- B. Do not place fill materials on frozen surfaces. Whenever the surface of a proposed cut or the site of an embankment is frozen or is covered with snow or ice, remove the frozen earth material, snow, and ice before placing the embankment material. Suspend placement operations if Work area is frozen or covered with snow to an extent that materials cannot be properly placed and compacted.
- C. Do not place frozen materials.
- D. Do not place excessively dry or wet embankment material. If necessary, manipulate the material as required to ensure that compaction will be performed at or near the optimum moisture content given in the moisture-density curve. Jetting or ponding of the backfill materials is not allowed.
- E. Dewater the Work area prior to placing any embankment or attempting compaction such that groundwater is not intruding into the material or wetting material in a manner that prevents compaction of materials at the specified moisture content.
- F. Compact areas inaccessible to rollers by hand using mechanical tampers (jumping jack, plate compactor, etc.) or other means as approved by ENGINEER, until the density conforms to adjacent compacted embankment.
- G. If it should become necessary, because of weather or other conditions, to suspend grading operations, blade the entire Work area until smooth, free of depressions and ruts, and crowned so no water can collect or be impounded.
- H. After the frost is out of the ground and the embankment is in suitable condition for the Work, finish to grade, cross-section, and compaction requirements, any embankment constructed during the winter or that was suspended due to frozen or snowy ground conditions.

### 3.6.3 Structure Embankment

- A. Adjacent to structures, place backfill materials in a manner that will prevent damage to the structures and allow the structures to assume the loads from fill gradually and uniformly. Increase the height of the fill adjacent to a structure at approximately the same rate on all sides of the structure. Maximum size of rock fragments allowed in backfill adjacent to the structure is 2 inches.
- B. Observe a minimum period of 14 calendar days after the placement of concrete, or until 90% of design strength has been attained through testing, before backfill materials are placed and compacted against any structure.

## 3.7 REMOVAL AND PLACEMENT OF DEFECTIVE FILL

Rework embankment and backfill materials not conforming to the density and moisture requirements until the requirements are achieved or remove and replace the non-conforming material with acceptable fill. The

replacement fill, foundations, abutment and fill surfaces upon which it is placed shall conform to all specifications. Remove and replace non-conforming materials at no cost to OWNER.

### 3.8 MOISTURE AND DENSITY REQUIREMENTS

- A. Compact each layer of embankment and backfill material until the in-place density equals or exceeds 95% of its maximum dry density. For excavation cuts, compaction shall be equal to or greater than that of the adjacent undisturbed material.
- B. Water and condition all embankment and backfill materials to obtain optimum moisture content  $\pm 3\%$  as determined by AASHTO T99.
- C. Perform all field density tests of the compacted materials on each lift at a minimum rate of 1 test for each 1,000 square yards, each 12 inches of material placed, and 1 test for each 1,000 square yards for all finished surfaces using the testing methods ASTM D6938/AASHTO T99.
- D. Provide laboratory density testing, by a certified laboratory, of materials to determine maximum dry density and optimum moisture content, using the testing methods ASTM D6938/AASHTO T99.
- E. CONTRACTOR shall collect samples for gradation, and moisture density characteristics of all materials placed and compacted, and provide copies of the results to ENGINEER prior to placement. At a minimum, provide laboratory results for each 5,000 cubic yards of material placed for all material types placed. If the total volume of material placed is less than 5,000 yards, provide 1 sample of each material type placed.
- F. ENGINEER may perform additional quality assurance field density tests of the compacted materials on behalf of OWNER. ENGINEER will measure the degree of compaction (field density) during embankment construction based on optimum moisture and maximum density curves for the appropriate material
- G. ENGINEER may conduct quality assurance verification of in-place moisture and compaction density using portable nuclear gauge testing procedures, during construction of certain subgrades and embankments.

### 3.9 HAUL

Haul materials in accordance with SECTION 02212 HAULING. The cost of hauling required materials is included in earthwork.

### 3.10 FINE GRADING

- A. Grade and compact the embankment as specified, after the earthwork has been substantially completed and all underground utilities, drainage facilities, etc., have been installed or adjusted to grade.
- B. Increase heights above grade and increase widths as necessary to allow for settlement, consolidation, or compaction. Finish side slopes to a reasonably uniform but rough surface that blends with the contours of surrounding undisturbed ground. Scarify smooth surfaces perpendicular to the slope of the ground.

### 3.11 GROWTH MEDIA

After fine grading is accepted by ENGINEER, replace salvaged topsoil or growth media in those areas to be fertilized and seeded in accordance with SECTION 02900 GROWTH MEDIA (COVER SOIL) and SECTION 02910 FERTILIZING AND SEEDING. Place salvaged woody debris on slopes as requested by ENGINEER or as specified in the Contract Documents.

## SECTION 02212

### HAULING

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section covers all labor, supplies, materials, equipment, and incidentals necessary for loading, hauling, and dumping of materials to designated areas or disposal sites in compliance with the Contract Documents.

##### 1.2 SUBMITTALS

##### Traffic Control Plan per SECTION 01570 TEMPORARY TRAFFIC CONTROL

##### Transportation Plan

Prepare and submit a Transportation Plan for approval by ENGINEER no later than 10 days prior to the start of any Work requiring hauling or delivery of materials to the Site. Include sequencing and scheduling of the Work.

#### PART 2 PRODUCTS

NOT USED

#### PART 3 EXECUTION

##### 3.1 TRANSPORTATION PLAN

A. Prepare a site-specific Transportation Plan including, but not limited to, the following:

1. Site maps and drawings showing anticipated equipment, haul routes, traffic flow patterns, parking areas, exclusion areas, staging areas, material storage areas, weed control stations, turnaround areas, and protected areas.
2. Procedures for training and/or informing employees, Subcontractors, vendors, and suppliers on Project specific requirements related to transporting materials and supplies to and from the Site.
3. Estimated time frames for delivery to the Site of materials needed to meet the Project schedule.
4. Notification procedures to warn or inform all parties of changing conditions or weather that may impact hauling and delivery operations.
5. Procedures to verify that all loaded equipment meets all applicable load or weight limits.
6. Procedures to verify that all hauling equipment and operators are properly licensed and insured.
7. Method of covering or securing loads for each applicable material type.
8. Procedures for reporting and cleaning up spilled materials.
9. Material type and load-specific procedures for hauling each type of material used for the Project. Specify what materials and loads will be covered, types of trucks allowed, load limits, etc., to ensure that materials are hauled in compatible loads to the appropriate location or facility (repository, licensed landfill, salvage yard, RCRA waste disposal facility, etc.).

B. Do not commence hauling activities until the Transportation Plan has been reviewed and approved by ENGINEER. Update or modify the plan as needed during the course of the Work.

### 3.2 TRAFFIC CONTROL

Provide all signing and traffic control, including flaggers if necessary in accordance with SECTION 01570 TEMPORARY TRAFFIC CONTROL.

### 3.3 ON-SITE TRANSPORTATION AND DISPOSAL

- A. Haul all specified materials to area(s) designated in the Contract Documents.
- B. Cover all loads transported over public roads.
- C. Belly dump trucks or trailers are not allowed for hauling any material over public roads.
- D. Decontaminate equipment before leaving the waste excavation and waste placement areas.
- E. Do not overload trucks such that spillage occurs. Clean up spilled material immediately.
- F. Notify ENGINEER immediately if spillage or an accident occurs.
- G. Track and record estimated daily and cumulative volume of material hauled. Provide this information to ENGINEER during the weekly coordination meetings.
- H. Observe all traffic laws and legal load limits if transporting material over public roads.
- I. Ensure that all roadways and other public access areas are kept clean and not tracked with soil or contaminated material from the excavation areas. Clean areas as requested by ENGINEER.
- J. Comply with all applicable weed decontamination and weed control measures.

### 3.4 OFF-SITE TRANSPORTATION AND DISPOSAL

- A. Dispose of debris, trash, and non-salvageable materials at an approved off-Site disposal facility in accordance with SECTION 02213 DEBRIS AND STRUCTURE DISPOSAL. Separate material commingled with mine waste prior to off-Site disposal. Transport materials in compatible loads and ensure they are delivered to the appropriate facility.
- B. Haul the specified materials to the appropriate facility described in the Special Provisions (if applicable). Haul all material in covered loads.
- C. Belly dump trucks or trailers are not allowed for hauling any material over public roads.
- D. Decontaminate equipment before leaving the waste excavation and waste placement areas.
- E. Do not overload trucks such that spillage occurs. Clean up spilled material immediately.
- F. Notify ENGINEER immediately if spillage or an accident occurs.
- G. Track and record estimated daily and cumulative volume of waste material hauled off-Site. Provide this information to ENGINEER during the weekly coordination meetings.
- H. Observe all traffic laws and legal load limits.
- I. Ensure that all roadways and other public access areas are kept clean and not tracked with soil or contaminated material from the excavation areas.
- J. Comply with all applicable weed decontamination and weed control measures.

## SECTION 02213

### DEBRIS AND STRUCTURE DISPOSAL

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section covers all labor, supplies, materials, equipment, and incidentals necessary for the separation and disposal of all non-hazardous debris, trash, and waste in compliance with the Contract Documents. Work includes demolition and disposal of specified structures and on-Site burning.

##### 1.2 SUBMITTALS

###### **Disposal Facility Information**

Submit a list of the licensed off-Site disposal site(s) that will receive the materials and documentation that clearly demonstrates that all debris was shipped to and accepted at the approved off-Site disposal facility. Submit weight tickets, landfill receipts, etc., necessary to support measurement and payment calculations.

###### **Burn Permit**

Submit all required county or state burn permits.

##### 1.3 REFERENCES

Publications listed below are incorporated into this specification by reference.

###### **Code of Federal Regulations (CFR), U.S. Environmental Protection Agency (EPA)**

40 CFR 261 Identification and Listing of Hazardous Waste

###### **Idaho Administrative Code**

58.01.06 Solid Waste Management Rules

##### 1.4 DEFINITIONS

###### 1.4.1 Debris

Debris is defined as the remains of any manmade objects found within the Site limits. Debris includes, but is not limited to, concrete, construction timbers, pipes, culverts, scrap metal, glass, garbage, and man-made material removed during clearing and grubbing, and other miscellaneous items. Debris does not include any identified or suspected RCRA hazardous waste.

###### 1.4.2 Structures

Structures include, but are not limited to, buildings (whole or incomplete), foundations, mining structures, fences, abandoned pipelines, vent pipes, and utility facilities.

###### 1.4.3 Disposal

Disposal is defined as the burning, burial, salvaging, or placement at an off-Site disposal facility of the debris and structural items identified or generated during Work at the Site including clearing, grubbing, excavation, and mine waste removal.

## **PART 2 PRODUCTS**

NOT USED

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- A. Dispose of all debris lying within the disturbance limits shown on the Drawings.
- B. Dispose of materials at a licensed Class II, Class III, or Class IV landfill, depending on the type of debris. Landfill classes are defined in ARM 17.50.503 and 504.
- C. Do not harm or injure structures that are to remain completely undisturbed for historical or archeological reasons.
- D. Backfill voids created from structure removal.
- E. Dislodge gross soil mass and remove as much mine waste and soil from the debris as feasible prior to separating or removing from the excavation area or transporting. Remove the majority of soil from debris by either mechanical or manual means so less than 2% by volume of any load transported to the landfill consists of soil.
- F. Collect all dislodged soil mass and mine waste and dispose of at an appropriate on- or off-Site facility in accordance with the Contract Documents or as by approved by ENGINEER.
- G. Segregate all debris and structures into the following material categories: salvage, burning, recycle or reuse, disposal, or burial.
- H. Prior to disposal, separate debris into categories and dispose of at the appropriate disposal facility in compatible loads.
- I. Crush, compact, and consolidate loose debris to the extent practicable as requested by ENGINEER. Payment will not be made for excessive yardage generated by placing loose or poorly compacted material.

### **3.2 SALVAGE**

- A. OWNER reserves the right to salvage any artifacts, historically significant materials, or other materials discovered at the Site. Coordinate with ENGINEER for the salvage of such materials. Any other salvage not designated by OWNER shall become the property of CONTRACTOR and must be removed from the Site or disposed of as specified herein.
- B. Carefully move and stockpile all materials denoted to be salvaged in the areas designated on the Drawings or at locations approved by ENGINEER. All salvaged materials shall be in sections or pieces that can be readily transported and/or reassembled. Neatly stack timber and other wood components on skids. Salvaged materials are not to be used by CONTRACTOR in the course of the Work unless stated otherwise in the Special Provisions.
- C. ENGINEER will determine if debris may be salvaged.

### **3.3 BURNING**

- A. Obtain state and county burn permits. Burning shall be conducted in compliance with ARM 17.8.601 through 17.8.612.
- B. Burning or burial of landfill debris is prohibited.
- C. Burning of materials will only be allowed when authorized in writing by the proper fire and air pollution control authorities, provided that all requirements set forth by such authorities are met.



- D. Permitted burning may take place at any time within the Contract period, weather conditions permitting.
- E. Prior to burning, obtain ENGINEER approval of burning locations in writing. Burning is not allowed in adit cuts or subsidence areas where there exists potential for igniting coal or spoils materials.
- F. Conduct burning operations a minimum of 100 feet away from any standing timber or flammable growth.
- G. Burning of materials will be allowed only if such burning operations can be performed without damage to the Site or adjacent properties. All combustible materials such as, but not limited to, trees, brush, trash, planks, wooden ties, timbers, etc., may be burned on-Site.
- H. Thoroughly burn all materials so that they are reduced to ashes, except for occasional charred pieces of logs or branches not exceeding 3 inches in diameter and/or 3 feet in length. If burning is incomplete, reapply slash and burn until the above size requirements are met. Upon approval of ENGINEER, bury charred material not consumed by the normal burning operation at approved locations with a minimum of 18 inches of cover.
- I. Maintain adequate fire-fighting equipment and personnel at the Site at all times during any burning. Include back tanks, flaps, shovels, rakes, etc., and a water truck equipped with a pump in the fire-fighting equipment. Prior to any burning, a demonstration of the fire-fighting water pump may be required. Guard fires and maintain constant surveillance until fires have burned out or have been extinguished.
- J. CONTRACTOR shall be responsible for any damage to life and/or property resulting from fires that are started by CONTRACTOR employees or as a result of operations.

### 3.4 RE-USE AND RECYCLE

- A. Whenever feasible, separate and recycle all recyclable materials and scrap metal. Clean recyclable materials as needed to be accepted by the recycling facility.
- B. Provide containers and receptacles as necessary to sort materials and facilitate transport.

### 3.5 BURIAL

- A. In certain cases, burial of debris and structure materials is allowed in areas designated for disposal of excess excavation or spoil, as approved by ENGINEER. Bury cleaned material with a minimum of 18 inches of cover. No burial will be allowed in areas to be used for permanent roadways, levees, or embankments unless approved by ENGINEER.
- B. Crush, cut, or otherwise treat debris and structure materials to be buried as requested by ENGINEER. Burial of large amounts of combustible materials on-Site is not allowed. Burial of small amounts of combustible materials may be allowed at the discretion of ENGINEER.

### 3.6 OFF-SITE DISPOSAL

Haul material which cannot be disposed of by burial, burning, or salvaging on-Site to an approved solid waste management facility at no additional cost to OWNER.

### 3.7 TRANSPORTATION

- A. Transport debris materials in trucks with an appropriate load covering system to prevent blown or spilled material along the haul route, including any public roadways, in accordance with SECTION 02212 HAULING and in compliance applicable federal, state, and local rules and regulations.

- B. Immediately clean up and reload spillage associated with loading and hauling of debris. Ensure that roadways and other public access areas are kept clean and not tracked with soil or contaminated material from the excavation areas.

## **SECTION 02236**

### **STOCKPILING OF MATERIALS**

#### **PART 1 GENERAL**

##### **1.1 DESCRIPTION**

This section covers all labor, supplies, materials, equipment, and incidentals necessary for stockpiling of all materials within the Project limits in compliance with the Contract Documents. Stockpiled materials include, but are not limited to, aggregates, riprap, cover soil, growth media, compost, lime, top soil, subsoil, sub base, base course, imported fill, general fill, and any other materials necessary to complete the Work as specified.

#### **PART 2 PRODUCTS**

NOT USED

#### **PART 3 EXECUTION**

##### **3.1 GENERAL**

- A. Material will be stockpiled in a mutually agreed upon location determined by CONTRACTOR and ENGINEER.
- B. Grub and clear stockpile locations prior to storage of material. The stockpile area shall be firm, smooth, and well drained.
- C. Build up coarse stockpiles in tiers of not more than 4 feet in thickness. Complete in place each tier before the next tier is placed. Do not allow material to "cone" down over the next lower tier.
- D. Dumping, casting, or pushing over the sides of stockpiles is prohibited except for fine aggregate stockpiles.
- E. Space stockpiles of different materials far enough apart or separate by suitable walls or partitions to prevent mixing of the materials during stockpiling, storage, and loading. Clearly label or delineate different material stockpiles to ensure that personnel can identify and obtain the proper material.
- F. Maintain a bed of material in the stockpiling and handling areas to avoid the inclusion of debris or foreign material in the stockpile. Do not use any stockpiling method that allows the stockpile to become contaminated with foreign matter or causes excessive degradation of the material. ENGINEER will collect samples from any portion of the stockpile that may be degraded to determine if that portion of the stockpile is degraded. CONTRACTOR shall discontinue the faulty stockpiling procedure if the material samples do not meet the specified requirements for the material.
- G. Transfer and load the materials from the stockpiles in a manner that preserves the uniform gradation and integrity of the material.

##### **3.2 CONVEYOR STOCKPILING**

When materials are stockpiled by conveyors, deposit the material in a succession of merging-cone piles. Do not drop material over 12 feet or allow cones to exceed 12 feet in height. Prior to starting another tier, level cones piles to a thickness of approximately 4 feet. Do not load trucks directly from the conveyor belt, or from a crusher or screening plant.

### 3.3 TRUCK STOCKPILING

When coarse materials are stockpiled by trucks, construct the stockpile in tiers, approximately 4 feet in thickness. Complete each tier before the next tier is started.

### 3.4 STORAGE BINS

When storage bins are required by the Contract Documents or requested by ENGINEER, provide a storage bin of sufficient capacity to ensure uniform quality and delivery of stored material.

### 3.5 MISCELLANEOUS MATERIALS

- A. Handle, stockpile, and protect miscellaneous materials for the Project including geotextiles, geocomposites, geosynthetics, coir fabrics, filter fence, straw wattles, erosion control mat, woody debris, plantings, cuttings, fertilizer, seed, pipes, culverts, etc., in accordance with the Contract Documents, industry standard practices, manufacturer's recommendations, and as approved by ENGINEER.
- B. Clearly label or delineate different material stockpiles to ensure that personnel can identify and obtain the proper material.

## SECTION 02410

### GEOTEXTILE

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section covers all labor, supplies, materials, equipment, and incidentals necessary for furnishing and installing geotextile materials in compliance with the Contract Documents. Geotextiles include, but are not limited to strong synthetic fabrics and/or coir fabrics and materials, woven, non-woven, biodegradable, and non-biodegradable materials specified for drainage, silt control, erosion control, separation, cushion, and embankment stabilization.

##### 1.2 REFERENCES

Publications listed below are incorporated into this specification by reference.

##### **American Society for Testing and Materials International (ASTM)**

ASTM D4354	Standard Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing
ASTM D4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
ASTM D4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4533	Standard Test Methods for Trapezoid Tearing Strength of Geotextiles
ASTM D4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D4759	Standard Practice for Determining the Specification Conformance of Geosynthetics
ASTM D4833	Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
ASTM D4873	Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D5199	Standard Test Method for Measuring Nominal Thickness of Geosynthetics
ASTM D5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles

##### 1.3 SUBMITTALS

##### **Geotextile Material Information and Certification**

Submit the following no later than 14 days prior to shipment of material:

- A. Manufacturer's catalog cut sheets and product specifications and manufacturer's certification that geotextile material complies with applicable standards, including test results for permeability, tensile and burst strength, and ultraviolet (UV) resistance.
- B. Manufacturer's installation recommendations, instructions, warranty, and material shipping, handling, and storage recommendations and requirements.
- C. Design calculations and material application guidelines for materials specified by CONTRACTOR.

#### 1.4 MANUFACTURER'S QUALIFICATIONS

Geotextile manufacturer shall have a minimum of 5 years of successful experience in the manufacturing of specified or like products.

### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. Provide geotextile materials manufactured from first quality materials that are suitably resistant to deterioration, certified by the manufacturer as being suitable for the Work, and meet the requirements in the Contract Documents. Provide only new products of recognized, reputable manufacturers. Used, reprocessed, or remanufactured products or materials are not acceptable.
- B. If a specific material is not specified in the Contract Documents, CONTRACTOR shall determine the appropriate specification based on the specific application, soil type, and Site conditions. Provide all calculations, material application guidelines, and manufacturer's recommendations necessary to support the material selection and submit to ENGINEER for approval.

#### 2.2 DRAINAGE GEOTEXTILE

Drainage fabric is used to allow water passage while retaining certain soil particles.

#### 2.3 BANK STABILIZATION GEOTEXTILE

Bank stabilization fabric is used to provide a filter medium beneath riprap or on slopes to prevent erosion.

#### 2.4 GRADE STABILIZATION GEOTEXTILE

Grade stabilization fabric is used to stabilize subgrades for roadways or prevent migration of fines into aggregate courses.

#### 2.5 FILTER FENCE

- A. Provide woven (directional) filter fence fabric with a stitched industrial netting backing designed for retention of silt in runoff. Furnish fabric in 100-foot continuous rolls at least 3 feet in width.
- B. Net backing may be 6 inches less than fabric width. Provide filter fence suitable for attachment to driven wood or steel posts.
- C. Procure, set, and anchor posts for filter fence installation according to manufacturer's recommendations.

## 2.6 WOODEN STAKES

- A. Provide construction stakes for coir fabric installation that are 18 inches long with a top (head) dimension of at least 1.5 inches in one axis (thickness) and 3 inches in the second axis (width).
- B. Construct stakes by diagonally rip-cutting a 2-inch x 4-inch piece of lumber, from top to bottom, across the 4-inch wide surface such that the top meets the minimum width and thickness specifications.

## 2.7 THREAD

Sewn seams shall be constructed with high-strength polyester, nylon, or other approved thread type with ultraviolet light stability equivalent to the geotextile. Thread color shall contrast with the geotextile to aid in inspection.

## 2.8 MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

Provide materials from manufacturers with an established quality control program ensuring compliance with the requirements of the applicable standards. Provide documentation describing the quality control program upon request. Product(s) not meeting the specified requirements shall be rejected.

# PART 3 EXECUTION

## 3.1 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, storage, and handling of geotextiles shall be in accordance with ASTM D4873. Comply with additional materials storage and handling methods and procedures requested by ENGINEER that are more stringent than ASTM D4873 and the manufacturer's recommendations. For example, ENGINEER may require that coir fabrics are stored off the ground and covered with secured tarps and may require cold storage depending on Site conditions.
- B. Material rolls shall be packaged and stored in an opaque, waterproof, protective plastic wrapping until installation to minimize damage from ultraviolet light, moisture, and mud during normal storage and handling. If quality assurance samples are collected, immediately rewrap rolls with the plastic wrapping. Repair or replace any plastic wrapping damaged during storage or handling.
- C. Identify each roll with a tag or label securely affixed to the outside of the roll on one end. The label shall include the manufacturer or supplier, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.
- D. Protect material from construction equipment, chemicals, sparks and flames, temperatures in excess of 160 °F, or any other environmental condition that may damage the physical properties of the geotextile. To protect material from becoming saturated, rolls shall either be elevated off the ground or placed on plastic sheeting in an area where water will not accumulate. Storage areas shall be free of weeds.
- E. Unload and handle material rolls with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Do not drag along the ground, lift by one end, or drop to the ground.
- F. Stockpile materials at locations mutually agreed upon by CONTRACTOR and ENGINEER in sufficient quantities to meet the Project schedule and requirements.
- G. Replace materials damaged during transport, storage, handling, or placement at no cost to OWNER.
- H. ENGINEER may randomly select and inspect samples from materials after arrival on the Site and prior to installation.

### 3.2 FILTER FENCE

- A. Install filter fence as shown on the Drawings and as requested by ENGINEER.
- B. Erect filter fence by attaching to driven wood or metal posts, or other suitable anchors described in the manufacturer's recommendations or as requested by ENGINEER at a maximum spacing of 10 feet. Prevent sags in fence that runoff water may overtop. If necessary to prevent sagging, back filter fence with metal mesh.
- C. Dig a trench along the filter fence installation and bury the filter fabric in the trench to secure the bottom of the fabric and prevent water from flowing under the filter fence.
- D. Install filter fence along contours and at the bottom of slopes.
- E. Construct flow breaks at least every 250 feet along the length of the filter fence to prevent concentrated flows from developing along the filter fence line. Do not install filter fence in concentrated flow areas.
- F. Lap joints in filter fence at a minimum of 5 feet and secure against breaching.

### 3.3 SUBGRADE PREPARATION

Compact and prepare the surface underlying the geotextile smooth and free of roots or protrusions which could damage the geotextile. Do not place geotextiles prior to inspection and approval of subgrade by ENGINEER.

### 3.4 INSTALLATION

- A. Notify ENGINEER a minimum of 3 days prior to installing geotextile. Repair or replace geotextile rolls that are damaged or contain imperfections as requested by ENGINEER at no cost to OWNER.
- B. Install geotextile to the lines and grades shown on the Drawings and in accordance with the manufacturer's recommended methods and as approved by ENGINEER.
- C. Roll geotextile down the slope in such a manner as to continuously keep geotextile in tension by self-weight. Securely anchor geotextile in an anchor trench where applicable, or by methods specified in the Contract Documents or as approved by ENGINEER.
- D. Lay geotextile flat and smooth in direct contact with the subgrade and free of tensile stresses, folds, and wrinkles. On slopes steeper than 10:1 (horizontal:vertical) lay geotextile with the machine direction of the fabric parallel to the slope direction. Expose no more than 500 square yards of geotextile at any one time.
- E. If necessary, anchor the geotextile down by weighting with 10-pound (minimum) sand bags placed at 1 bag every 9 square feet or as approved by ENGINEER. Leave weighting in place until replaced with cover material.
- F. Do not entrap soil, stones, or excessive moisture during installation of geotextile which could hinder required seaming.

### 3.5 SEAMING

#### 3.5.1 Overlap Seams

- A. Continuously overlap geotextile panels a minimum of 12 inches at all longitudinal and transverse joints. Where seams must be oriented across the slope, lap the upper panel over the lower panel. If approved by ENGINEER, sewn seams may be used instead of overlapped seams.
- B. Seam geotextiles using heat seaming or stitching methods as recommended by the manufacturer and approved by ENGINEER. All sewn seams shall be continuous and oriented down slopes perpendicular to grading contours unless otherwise specified.



### 3.5.2 Sewn Seams

- A. Make field seams using sewing machines and thread specifically adapted for this purpose. Overlap adjacent panels a minimum of 3 inches and sew together. Sew seams using one row of stitching with 4 to 7 stitches per inch, or the manufacturer's recommended pattern.
- B. When sewing a flat seam, the stitching should be approximately 1.5 inches from the outside edge of the fabric, but not in the selvage or at the selvage edge. The "J"-fold and butterfly fold seams require a fold of 1.25 to 2 inches from the fabric edge with the stitching approximately 1 inch from the folded edge. Ensure that the two fabric edges are near even during seaming.
- C. Patch damaged areas of geotextile with an additional layer of geotextile material heat bonded to the main layer of geotextile and overlapping the damaged area by a minimum of 6 inches on each side. Use sewing thread of a contrasting color to the fabric to facilitate visual seam inspection. Ensure no soil or other materials are present within seams or overlaps.

### 3.5.3 Heat Seams

- A. For geotextiles 6 ounces per square yard or heavier, fusion seaming with a fusion wedge welder may be used with a minimum overlap of 4 inches.
- B. Prior to fusion seaming the geotextile together, demonstrate to ENGINEER the ability to perform this type of installation. Repair areas burned through by fusion welding at no cost to OWNER.

### 3.5.4 Heat Bonding/Tacking

- A. For geotextiles 6 ounces per square yard or lighter, a hand held hot air welder or torch may be used to continuously or spot bond the non-woven geotextile together with a minimum overlap of 6 inches.
- B. Repair areas damaged by heat bonding/tacking at no cost to OWNER.

## 3.6 PROTECTION

- A. Protect geotextile from clogging, entrapment of soil, stones or excessive moisture, tears, and other damage during installation.
- B. Cover geotextile, where required, as soon as possible after installation and approval by ENGINEER. Do not leave placed geotextile exposed for more than 7 days.

## 3.7 REPAIR AND REPLACEMENT

- A. Repair or replace damaged geotextile as requested by ENGINEER.
- B. Repair by placing a patch of the same geotextile over the damaged area, extending a minimum of 12 inches beyond the edge of the damaged area. Fasten all patches with a continuous bond using approved methods and align the machine direction of the patch with the machine direction of the geotextile being repaired.
- C. Perform repairs at no additional cost to OWNER.
- D. Remove and replace geotextile rolls that cannot be repaired.

## 3.8 PENETRATIONS

Construct engineered penetrations of the geotextile using manufacturer's recommended methods.

### 3.9 COVERING

- A. Where required, cover geotextile after inspection and approval by ENGINEER. Install cover soil in a manner that prevents soil from entering the geotextile overlap zone and minimizes tensile stress from equipment pushing material over the geotextile. Prevent wrinkles from folding at the seams or elsewhere on the geotextile.
- B. Dump cover soil along the edges of the geotextile and push toward the center using low-ground pressure, tracked equipment. Do not operate equipment directly on top of the geotextile. Use equipment with ground pressures less than 7 pounds per square inch to place the first lift over the geotextile. Do not turn equipment on the first lift of material, blade the first lift, or use sheepsfoot or studded compaction equipment. Use only rubber tired rollers for compaction if foundation failures occur when placing subsequent lifts. Place fill in uniform layers.
- C. Avoid using any construction equipment that may cause rutting in excess of 3 inches on the first lift. For rutting that exceeds 3 inches, decrease the size and/or weight of the construction equipment or increase the lift thickness.
- D. On side slopes, place riprap backfill from the bottom of the slope upward. Do not drop riprap material onto the geotextile from a height greater than 1 foot. Equipment placing riprap shall not stop abruptly, make sharp turns, spin their tracks or wheels, or travel at speeds exceeding 5 miles per hour.

## SECTION 02420

### FLEXIBLE GEOMEMBRANE LINER

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section covers all labor, supplies, materials, equipment, and incidentals necessary for furnishing and installing flexible geomembrane liner materials in compliance with the Contract Documents. Flexible geomembrane liners include linear low density polyethylene (LLDPE), high density polyethylene (HDPE), polyvinyl chloride (PVC), polypropylene (PP) and Hypalon (HP) liner materials. Materials include textured and non-textured surface types.

##### 1.2 REFERENCES

Publications listed below are incorporated into this specification by reference.

##### **American Society for Testing and Materials International (ASTM)**

ASTM D413	Standard Test Methods for Rubber Property - Adhesion to Flexible Substrate
ASTM D751	Standard Test Methods for Coated Fabrics
ASTM D792	Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D882	Standard Test Method for Tensile Properties of Thin Plastic Sheeting
ASTM D1004	Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
ASTM D1204	Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
ASTM D1790	Standard Test Method for Brittleness Temperature of Plastic Sheeting by Impact
ASTM D4833	Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
ASTM D4873	Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D5199	Standard Test Method for Measuring Core Thickness of Textured Geomembrane
ASTM D5994	Standard Test Method for Measuring Nominal Thickness of Geosynthetics
ASTM D6693	Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes

##### 1.3 SUBMITTALS

##### **Geomembrane Material Information and Certification**

Submit the following no later than 14 days prior to shipment of material:

- A. Manufacturer's catalog cut sheets and product specifications and manufacturer's certification that geomembrane material complies with applicable standards, including test results for permeability, tensile and burst strength, and ultraviolet (UV) resistance.
- B. Manufacturer's installation recommendations, instructions, warranty, and material shipping, handling, and storage recommendations and requirements.
- C. Design calculations and material application guidelines for materials specified by CONTRACTOR.

#### 1.4 MANUFACTURER'S QUALIFICATIONS

Geomembrane manufacturer shall have a minimum of 5 years of successful experience in the manufacture of specified or like products.

### PART 2 PRODUCTS

#### 2.1 GENERAL

- A. Provide geomembrane materials manufactured from first quality materials that are suitably resistant to deterioration, certified by the manufacturer as being suitable for the Work, and meet the requirements of these specifications. Provide only new products of recognized, reputable manufacturers. Used, reprocessed, or remanufactured products or materials are not acceptable.
- B. If a specific material is not specified in the Contract Documents, CONTRACTOR shall determine the appropriate specification based on the specific application, soil type, and Site conditions. Provide all calculations, material application guidelines, and manufacturer's recommendations necessary to support the material selection and submit to ENGINEER for approval.

#### 2.2 FLEXIBLE GEOMEMBRANE LINER

Flexible geomembrane is a very low permeability material used for control of fluids through the containment (liner) or prevention (caps) to the environment.

#### 2.3 MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

Provide materials from manufacturers with an established quality control program to ensure compliance with the requirements of the applicable standards. Provide documentation describing the quality control program upon request. Product(s) not meeting the specified requirements shall be rejected.

### PART 3 EXECUTION

#### 3.1 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, storage, and handling of geomembrane materials shall be in accordance with ASTM D4873. Comply with additional materials storage and handling methods and procedures requested by ENGINEER that are more stringent than ASTM D4873 and the manufacturer's recommendations. For example, ENGINEER may require that geomembrane materials are stored off the ground and covered with secured tarps.
- B. Material rolls shall be packaged and stored in an opaque, waterproof, protective plastic wrapping until installation to minimize damage from ultraviolet light, moisture, and mud during normal storage and handling. If quality assurance samples are collected, immediately rewrap rolls with the plastic wrapping. Repair or replace any plastic wrapping damaged during storage or handling.

- C. Identify each roll with a tag or label securely affixed to the outside of the roll on one end. The label shall include the manufacturer or supplier, geomembrane type, roll number, roll dimensions (length, width, gross weight), and date manufactured.
- D. Protect material from construction equipment, chemicals, sparks and flames, temperatures in excess of 160 °F, or any other environmental condition that may damage the physical properties of the geomembrane. To protect material from becoming saturated, rolls shall either be elevated off the ground or placed on plastic sheeting in an area where water will not accumulate. Storage areas shall be free of weeds.
- E. Wood pallets shall not be used since protruding nails can damage the liners.
- F. Unload and handle material rolls with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Do not drag along the ground, lift by one end, or drop to the ground.
- G. Stockpile materials at locations mutually agreed upon by CONTRACTOR and ENGINEER in sufficient quantities to meet the Project schedule and requirements.
- H. Replace materials damaged during transport, storage, handling, or placement at no cost to OWNER.

### 3.2 SUBGRADE PREPARATION

Compact and prepare the surface underlying the geomembrane smooth and free of roots or protrusions which could damage the geomembrane. Do not place geomembranes prior to inspection and approval of subgrade by ENGINEER.

### 3.3 INSTALLATION

- A. Notify ENGINEER a minimum of 3 days prior to installing flexible geomembrane materials. Repair or replace flexible geomembrane rolls which are damaged or contain imperfections as requested by ENGINEER at no cost to OWNER.
- B. Install flexible geomembrane materials to the lines and grades as shown on the Drawings and in accordance with the manufacturer's recommended method and as approved by ENGINEER.
- C. Lay the flexible geomembrane flat and smooth in direct contact with the subgrade and free of tensile stresses, folds, and wrinkles. Expose no more than 500 square yards of flexible geomembrane at any one time.
- D. If necessary, anchor the geomembrane down by weighting with 10-pound (minimum) sand bags placed at 1 bag every 9 square feet or as approved by ENGINEER. Leave weighting in place until replaced with cover material.
- E. Do not entrap soil, stones, or excessive moisture during installation of flexible geomembrane that could hinder required seaming.
- F. Equipment necessary to perform the installation (generators, compressors, etc.) shall have a scrap geomembrane sheet placed underneath to protect the installed geomembrane from possible damage.

### 3.4 SEAMING

#### 3.4.1 Sewn Seams

- A. Make field seams using sewing machines and thread specifically adapted for this purpose. Overlap adjacent panels a minimum of 3 inches and sew together. Sew seams using one row of stitching with 4 to 7 stitches per inch, or the manufacturer's recommended pattern.
- B. When sewing a flat seam, the stitching should be approximately 1-1/2 inches from the outside edge of the fabric, but not in the selvage or at the selvage edge. The "J"-fold and butterfly fold seams require a

fold of 1-1/4 to 2 inches from the fabric edge with the stitching approximately 1 inch from the folded edge. Ensure that the two fabric edges are near even during seaming.

- C. Patch damaged areas of geomembrane with an additional layer of geomembrane material heat bonded to the main layer of geomembrane and overlapping the damaged area by a minimum of 6 inches on each side. Use sewing thread of a contrasting color to the fabric to facilitate visual seam inspection. Ensure no soil or other materials are present within seams or overlaps.

#### 3.4.2 Heat Seams

- A. For flexible geomembranes utilizing a fusion wedge welder, the minimum overlap for this type of welding is 4 inches, or manufacturer's recommendation.
- B. Prior to fusion seaming the geomembrane together, demonstrate to ENGINEER the ability to perform this type of installation. Repair areas burned through by fusion welding at no cost to OWNER.

#### 3.5 PROTECTION

- A. Protect geomembrane from clogging, entrapment of soil, stones or excessive moisture, tears, and other damage during installation.
- B. Cover geomembrane, where required, as soon as possible after installation and approval by ENGINEER. Do not leave placed geomembrane exposed for more than 7 days.

#### 3.6 REPAIR AND REPLACEMENT

- A. Repair or replace damaged geomembrane as requested by ENGINEER.
- B. Repair by placing a patch of the same geomembrane over the damaged area, extending a minimum of 12 inches beyond the edge of the damaged area. Fasten all patches with a continuous bond using approved methods.
- C. Perform repairs at no additional cost to OWNER.

#### 3.7 PENETRATIONS

Construct engineered penetrations of the geomembrane by methods recommended by the geomembrane manufacturer.

#### 3.8 COVERING

- A. Where required, cover geomembrane after inspection and approval by ENGINEER. Install cover soil in a manner that minimizes tensile stress from equipment pushing material over the geomembrane. Prevent wrinkles from folding at the seams or elsewhere on the geomembrane.
- B. Dump cover soil along the edges of the geomembrane and push toward the center using low-ground pressure, tracked equipment. No equipment shall be operated directly on top of the geomembrane. Equipment with ground pressures less than 7 pounds per square inch shall be used to place the first lift over the geomembrane. Do not turn equipment on the first lift of material, blade the first lift or use sheepfoot or studded compaction equipment. Use only rubber tired rollers for compaction if foundation failures occur when placing subsequent lifts. Place fill in uniform layers.
- C. Avoid using any construction equipment that may cause rutting in excess of 3 inches on the first lift. For rutting that exceeds 3 inches, decrease the size and/or weight of the construction equipment or increase the lift thickness.

## SECTION 02430

### GEOCOMPOSITE DRAINAGE LAYER

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section covers all labor, supplies, materials, equipment, and incidentals necessary for furnishing and installing a geocomposite drainage layer, including both geonet and geocomposite materials, in compliance with the Contract Documents.

##### 1.2 REFERENCES

Publications listed below are incorporated into this specification by reference.

##### **American Society for Testing and Materials International (ASTM)**

ASTM D1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique
ASTM D1603	Standard Test Method for Carbon Black Content in Olefin Plastics
ASTM D4218	Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
ASTM D4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D4491	Standard Test Method for Water Permeability of Geotextiles by Permittivity
ASTM D4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D4716	Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
ASTM D4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D4833	Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
ASTM D4873	Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D5035	Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
ASTM D5199	Standard Test Method for Measuring Nominal Thickness of Geosynthetics
ASTM D5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles
ASTM D7005	Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites

### 1.3 SUBMITTALS

#### **Geocomposite Material Information and Certification**

Submit the following no later than 14 days prior to shipment of material:

- A. Manufacturer's catalog cut sheets and product specifications and manufacturer's certification that geocomposite material complies with applicable standard, including test results for permeability, tensile and burst strength, and ultraviolet (UV) resistance.
- B. Manufacturer's installation recommendations, instructions, warranty, and material shipping, handling, and storage recommendations and requirements.

### 1.4 MANUFACTURER'S QUALIFICATIONS

Geocomposite drainage layer manufacturers shall have a minimum of 5 years of successful experience in the manufacture of like products.

## **PART 2 PRODUCTS**

### 2.1 GEOCOMPOSITE DRAINAGE LAYER

- A. The geocomposite shall consist of a layers of non-woven, needle punched geotextile, thermally bonded to both sides of the internal drainage net or structure. The internal drainage net (geonet) shall consist of an integrally formed high density polyethylene (HDPE) structure, with uniform channels, sufficient open area, and thickness to ensure uniform flow throughout the material. The geotextile shall not be bonded to the drainage net within 6 inches of the edges of the rolls.
- B. Where applicable, property values in Table 1 represent minimum average roll values (MARV). The value for apparent opening size (AOS) represents the maximum average roll value (MaxARV). The geocomposite drainage layer shall meet the MARV requirements in the weakest principal direction.

<b>TABLE 1 - GEOCOMPOSITE DRAINAGE LAYER PROPERTIES</b>			
<b>Property</b>	<b>Test Method</b>	<b>Test Value</b>	<b>Minimum MQC Testing Frequency</b>
<b>GEONET COMPONENT</b>			
Thickness, min. (avg.) <sup>1</sup>	ASTM D5199	5 mm to 200 mil	100,000 sq ft
Polymer Density, min.(avg.)	ASTM D1505	0.940 gram/cc	100,000 sq ft
Carbon Black Content	ASTM D1603 ASTM D4218	1-3%	100,000 sq ft
Tensile Strength, min. (avg.) <sup>2</sup>	ASTM D5035	45 lbs/inch	100,000 sq ft
<b>GEOTEXTILE COMPONENT</b>			
Mass/Unit Area, MARV	ASTM D5261	6.0 oz/sq yd	100,000 sq ft
Grab Strength, MARV	ASTM D4632	157 lbs	100,000 sq ft



TABLE 1 - GEOCOMPOSITE DRAINAGE LAYER PROPERTIES			
Property	Test Method	Test Value	Minimum MQC Testing Frequency
Grab Elongation, MARV	ASTM D4632	50%	100,000 sq ft
Tear Strength, MARV	ASTM D4533	55 lbs	100,000 sq ft
Puncture Strength, MARV	ASTM D4833	55 lbs	100,000 sq ft
Permittivity, MARV	ASTM D4491	0.2/sec	500,000 sq ft
AOS(O95), MaxARV	ASTM D4751	0.25 mm	500,000 sq ft
UV Stability, percent retained (500 hours) <sup>3</sup>	ASTM D4355	50%	---
GEOCOMPOSITE			
Transmissivity, min, incl. attached geotextiles <sup>4</sup>	ASTM D4716	See Special Provisions	200,000 sq ft
Geonet/Geotextile Adhesion, min. (avg.) <sup>5</sup>	ASTM D7005	0.5 lbs/inch	100,000 sq ft

MQC – Manufacturer's Quality Control

<sup>1</sup>The diameter of the presser foot shall be 2.22 inches and the pressure shall be 2.9 psi. For other thickness options, see manufacturer's literature.

<sup>2</sup>Test value is the average peak value for five equally spaced machine direction tests across the roll width.

<sup>3</sup>Manufacturer's historical data.

<sup>4</sup>Manufacturing quality control transmissivity tests shall be measured using a gradient of 0.1 under a normal pressure of 1.45 psi. Use a minimum seating period of 15 minutes. Perform the test between rigid end platens.

<sup>5</sup>Average of 5 tests across the roll width. Discounting the outer 1 foot of each side of the roll, collect samples at the 50% positions across the roll width. Test both sides for double-sided geocomposites.

## 2.2 MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

Provide materials from manufacturers with an established quality control program ensuring compliance with the requirements of the applicable standards. Provide documentation describing the quality control program upon request. Product(s) not meeting the specified requirements shall be rejected.

## PART 3 EXECUTION

### 3.1 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, storage, and handling of geocomposites shall be in accordance with ASTM D4873. Comply with additional materials storage and handling methods and procedures requested by ENGINEER that are more stringent than ASTM D4873 and the manufacturer's recommendations.
- B. Material rolls shall be packaged and stored in an opaque, waterproof, protective plastic wrapping until installation to minimize damage from ultraviolet light, moisture, and mud during normal storage and handling. If quality assurance samples are collected, immediately rewrap rolls with the plastic wrapping. Repair or replace any plastic wrapping damaged during storage or handling.

- C. Identify each roll with a tag or label securely affixed to the outside of the roll on one end. The label shall include the manufacturer or supplier, geocomposite type, roll number, roll dimensions (length, width, gross weight), and date manufactured.
- D. Protect materials from construction equipment, chemicals, sparks and flames, temperatures in excess of 160 °F, or any other environmental condition that may damage the physical properties of the geotextile. To protect material from becoming saturated, rolls shall either be elevated off the ground or placed on plastic sheeting in an area where water will not accumulate. Storage areas shall be free of weeds.
- E. Unload and handle material rolls with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Do not drag along the ground, lift by one end, or drop to the ground.
- F. Stockpile materials at locations mutually agreed upon by CONTRACTOR and ENGINEER in sufficient quantities to meet the Project schedule and requirements.
- G. Replace materials damaged during transport, storage, handling, or placement at no cost to OWNER.
- H. ENGINEER may randomly select and inspect samples from materials after arrival on-Site and prior to installation.

### 3.2 SUBGRADE PREPARATION

Compact and prepare the surface underlying the geocomposite drainage layer smooth and free of roots or protrusions which could damage the material. Do not place the geocomposite drainage layer prior to inspection and approval of subgrade by ENGINEER.

### 3.3 INSTALLATION

- A. Notify ENGINEER a minimum of 3 days prior to installation of geocomposite drainage layer. Repair or replace geocomposite drainage layer rolls which are damaged or contain imperfections as requested by ENGINEER at no cost to OWNER.
- B. Install geocomposite drainage layer to the lines and grades as shown on the Drawings and in accordance with the manufacturers recommended method and as approved by ENGINEER.
- C. Lay the geocomposite drainage layer flat and smooth in direct contact with the subgrade and free of tensile stresses, folds, and wrinkles. Expose no more than 500 square yards of geocomposite drainage layer at any one time.
- D. If necessary, anchor the geocomposite drainage layer down by weighting with 10-pound (minimum) sand bags placed at 1 bag every 9 square feet or as approved by ENGINEER. Leave weighting in place until replaced with cover material.
- E. Do not to entrap soil, stones, or excessive moisture during installation of geocomposite drainage layer that could hinder required seaming.

### 3.4 SEAMS

#### 3.4.1 Geonet Side Seams

Overlap geonet side seams a minimum of 4 inches and space side seam fasteners at 5 foot (maximum) intervals. In anchor trenches, reduce fastener spacing to a maximum of 1 foot.

#### 3.4.2 Geonet End Seams

Overlap geonet end seams a minimum of 1 foot in the direction of flow and attach end seam fastener spaced at a maximum of 1 foot.

#### 3.4.3 Geonet Fasteners

Tie geonet rolls together with plastic fasteners. Use fasteners of a contrasting color from the geonet and attached geotextiles. Metallic fasteners are not allowed.

#### 3.4.4 Geotextile Seams

Overlap the geotextile component of the geocomposite in the direction of flow and thermally bond or sew using approved methods per the manufacturer and as approved by ENGINEER.

#### 3.4.5 Geotextile Cap Strips

Place geotextile cap strips over any exposed edges of geocomposite. Provide and install cap strips a minimum of 2 feet in width. Thermally bond the cap strips to geotextile component of the geocomposite.

#### 3.4.6 Stacked Geocomposite Drainage Layers

Where geocomposite drainage layers are to be stacked, stagger roll ends and edges so that joints do not lie above one another.

### 3.5 PROTECTION

- A. Protect the geocomposite drainage layer rolls from clogging, entrapment of soil, rocks, excessive moisture, tears, and other damage during installation. Repair or replace damaged geocomposites as requested by ENGINEER at no additional cost to OWNER.
- B. Cover geocomposite drainage layer as soon as possible after installation and approval. Placed geocomposite drainage layer shall not be left exposed for more than 7 days.

### 3.6 REPAIR AND REPLACEMENT

- A. Repair or replace damaged geocomposite drainage layer as requested by ENGINEER.
- B. Repair geonet by placing a patch of the geocomposite drainage layer over the damaged area, extending the patch a minimum of 2 feet beyond the edge of the damage. Use approved fasteners, spaced every 6 inches around the patch, to hold the patch in place. If more than 25% of the roll is damaged, replace the damaged roll.
- C. Repair damaged geotextile by placing a patch of geotextile over the damaged area with a minimum of 12 inches of overlap in all directions. Thermally bond the geotextile patch in place.
- D. Complete all replacement and repairs at no cost to OWNER.

### 3.7 PENETRATIONS

Mechanically attach a geotextile apron to pipes and other appurtenances penetrating through the drainage layer so that soil is prevented from getting into the drainage layer. The apron of the attached geotextile shall extend out from the pipe or appurtenance a minimum of 2 feet and be thermally bonded to the geotextile overlying the geonet.

### 3.8 COVERING

- A. Cover the geocomposite drainage layer after inspection and approval by ENGINEER. Place cover soil from the bottom of the slope upward and do not drop directly onto the drainage layer from a height greater than 3 feet. Push the cover soil out over the geocomposite drainage layer in an upward tumbling motion so that wrinkles in the drainage layer do not fold over. Do not operate equipment on the top surface of the geocomposite drainage layer.

- B. Dump cover soil along the edges of the geotextile and pushed toward the center using low-ground pressure, tracked equipment. Do not operate equipment directly on top of the material. Use equipment with ground pressures less than 7 pounds per square inch to place the first lift. Do not turn equipment on the first lift of material, blade the first lift or use sheepsfoot or studded compaction equipment. Use only rubber tired rollers for compaction if foundation failures occur when placing subsequent lifts. Place fill in uniform layers.
- C. Avoid using any construction equipment that may cause rutting in excess of 3 inches on the first lift. For rutting that exceeds 3 inches, decrease the size and/or weight of the construction equipment or increase the lift thickness.
- D. If rutting greater than 3 inches occurs, CONTRACTOR shall expose material in the rutted area and allow inspection by ENGINEER. If ENGINEER determines that the material has been damaged by the rutting or equipment operations, CONTRACTOR shall remove and replace the entire damaged area at no cost to OWNER.

## SECTION 02440

### GEOSYNTHETIC CLAY LINER

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section covers all labor, supplies, materials, equipment, and incidentals necessary for the furnishing and installing a geosynthetic clay liner (GCL) in compliance with the Contract Documents.

##### 1.2 REFERENCES

Publications listed below are incorporated into this specification by reference.

##### **American Society for Testing and Materials International (ASTM)**

ASTM D792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique
ASTM D4873	Standard Specification for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D5199	Standard Test Method for Measuring Nominal Thickness of Geosynthetics
ASTM D5261	Standard Test Method for Measuring Mass Per Unit Area of Geotextiles
ASTM D5887	Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter
ASTM D5888	Standard Guide for Storage and Handling of Geosynthetic Clay Liners
ASTM D5889	Standard Practice for Quality Control of Geosynthetic Clay Liners
ASTM D5890	Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners
ASTM D5891	Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners
ASTM D5993	Standard Test Method for Measuring Mass Per Unit of Geosynthetic Clay Liners
ASTM D5994	Standard Test Method for Measuring Core Thickness of Textured Geomembrane
ASTM D6496	Standard Test Method for Determining Average Bonding Peel Strength Between Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners
ASTM D6768	Standard Test Method for Tensile Strength of Geosynthetic Clay Liners

##### 1.3 SUBMITTALS

##### **GCL Installation Plan**

Prepare and submit a GCL Installation Plan for approval by ENGINEER no later than 10 days prior to the start of any Work. Include sequencing and scheduling.

#### **GCL Manufacturer Qualifications**

Submit the following no later than 14 days prior to shipment of material:

- A. Manufacturer's qualification statements.
- B. Manufacturer's certified raw and roll material data sheets. The certified data sheets shall be attested to by a person having legal authority to bind the GCL manufacturing company.
- C. Certified test results. If needle punching or stitch bonding is used in construction of GCL, the certification shall indicate that the GCL has been continuously inspected for broken needles using an in-line metal detector and all broken needles have been removed.

### **1.4 MANUFACTURER'S QUALIFICATIONS**

GCL manufacturer shall have produced the proposed GCL for at least 5 continuous years and have produced a total minimum area of five (5) million square feet of GCL.

## **PART 2 PRODUCTS**

### **2.1 GEOSYNTHETIC CLAY LINER**

- A. The GCL shall be a manufactured product consisting of a sodium montmorillonite clay (bentonite) layer evenly distributed between two (2) geotextiles or attached to a polyethylene geomembrane. The exposed surface of the polyethylene membrane can be smooth or textured.
- B. Encapsulating geotextiles shall be mechanically bonded together using a needle punch or stitch bonding process. The GCL shall be free of tears, holes, or other defects that may affect its serviceability.
- C. Minimum overlap guide-line and a construction match-line delineating the overlap zone shall be imprinted with non-toxic ink on both edges of the GCL panel to ensure the accuracy of the seam and achieve the minimum overlap.
- D. Woven/nonwoven geotextiles shall have a minimum seam overlap of 6 inches for scrim reinforced and 12 inches minimum for all non-scrim reinforced nonwoven GCLs. End of panel or butt end seams shall be a minimum of 12 inches for all woven/nonwoven GCLs, 12 inches for all scrim-reinforced double nonwoven GCLs, and 24 inches for non-scrim reinforced double nonwoven GCLs.
- E. Bentonite used for sealing seams, penetrations, or repairs, shall have the same properties as the granular bentonite used in the production of the GCL.
- F. The GCL shall meet the minimum average roll values (MARV) requirements that meet the test method in Table 1 below or specified in the Special Provisions.

TABLE 1 - GCL PROPERTIES <sup>1</sup>		
	Test Method	Test Value
<b>BENTONITE</b>		
Swell Index Test, minimum	ASTM D5890	24 mL
Fluid Loss, maximum	ASTM D5891	18 mL
<b>UPPER GEOTEXTILE PROPERTIES</b>		
Material Type		Woven/Nonwoven
Mass per Unit Area, minimum	ASTM D5261	6 oz/sq yd (min) or as specified in Special Provisions
<b>LOWER GEOTEXTILE PROPERTIES</b>		
Material Type		Woven/Nonwoven
Mass per Unit Area, min.	ASTM D5261	6 oz/sq yd (min) or as specified in Special Provisions
<b>GEOMEMBRANE</b>		
Thickness, minimum	ASTM D5199 ASTM D5994	As Specified in Special Provisions
Sheet Density, minimum	ASTM D1505 ASTM D792	0.92 g/cc
<b>COMPOSITE</b>		
Bentonite Mass per Unit Area, minimum <sup>2</sup>	ASTM D5993	0.75 lbs/sq ft
Moisture Content, maximum	ASTM D5993	12%
Tensile Strength, minimum,	ASTM D6768	30 lbs/inch
Index Flux, maximum	ASTM D5887	$1 \times 10^{-8}$ m <sup>3</sup> /m <sup>2</sup> /sec
Peel Strength <sup>3</sup> , minimum Peel Strength, MARV	ASTM D6496	3.5 lbs/inch

<sup>1</sup>U.S. Army Corps of Engineers - Unified Facilities Guide Specification

<sup>2</sup>Bentonite mass/unit area shall be computed at 0% moisture content. Bentonite mass/unit area is exclusive of glues added to the bentonite.

<sup>3</sup>The peel test applies to geotextile backed GCL products only.

## 2.2 MANUFACTURING QUALITY CONTROL SAMPLING AND TESTING

Provide materials from manufacturers with an established quality control program to ensure compliance with the requirements of the applicable standards. Provide documentation describing the quality control program upon request. Product(s) not meeting the specified requirements shall be rejected.

## PART 3 EXECUTION

### 3.1 GCL INSTALLATION PLAN

A. Prepare and submit to ENGINEER a GCL Installation Plan including, but not limited to, the following:

1. Procedures for unloading and storage of GCL rolls.
2. Method of GCL placement. Design the layout to keep field seams of the GCL to a minimum and consistent with proper methods of GCL installation.
3. Weather considerations.
4. GCL seaming and repair procedures.
5. Verification of the GCL specifications and manufacturer's experience.
6. Test reports and QC certificates.

### 3.2 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle the GCL in accordance with ASTM D5888. Comply with additional materials storage and handling methods and procedures requested by ENGINEER that are more stringent than ASTM D5888 and the manufacturer's recommendations.
- B. ENGINEER will be present during delivery and unloading of the GCL. Unload rolls from the delivery vehicles in a manner that prevents damage to the GCL and its packaging.
- C. Each GCL roll shall be labeled with the manufacturer's name, product identification number, roll number, and roll dimensions. Rolls shall be packaged in an opaque, waterproof, protective UV resistant covering and wrapped around a central core.
- D. Repair or restore tears in the packaging to restore a waterproof protective barrier around the GCL.
- E. The presence of free-flowing water within the packaging of unreinforced GCL shall require that roll to be rejected for use.

#### 3.2.1 Storage

- A. Protect rolls of GCL from construction equipment, chemicals, sparks, and flames, temperatures in excess of 160 °F, or any other environmental conditions that may damage the physical properties of the GCL. Temporary storage at the Site shall be on a level surface that is free of weeds and sharp objects, and where water cannot accumulate.
- B. Storage of the rolls on blocks or pallets will not be allowed unless the GCL rolls are fully supported as approved by ENGINEER.
- C. GCL rolls shall not be stacked greater than three (3) high. Cover GCL rolls stored outdoors with a water-proof tarpaulin or plastic sheet.
- D. Store bagged bentonite material on pallets or other suitably dry surface to prevent undue pre-hydration. Tarp material next to GCL rolls unless other more protective measures are available.

#### 3.2.2 Handling

- A. Unload and handle GCL rolls with load carrying straps, a fork lift with a stinger bar, roller cradles, or a spreader bar assembly.
- B. Use a pipe or solid bar of sufficient strength to support the full weight of a roll without significant bending. Chains shall be used to link the ends of the pipe or bar to the ends of a spreader bar. The spreader bar shall be wide enough to prevent the chains from rubbing against the ends of the roll.
- C. The stinger bar shall be at least three-fourths (3/4) the length of the core and capable of supporting the full weight of the roll without significant bending.
- D. Roller cradles support the entire width of the GCL roll and allow it to unroll freely.
- E. If recommended by the manufacturer, a sling handling method utilizing appropriate loading straps may be used.
- F. Do not drag GCL rolls along the ground, lift by one end, or drop to the ground.



### 3.3 SUBGRADE PREPARATION

- A. Prepare the surface underlying the GCL to be smooth and free of roots or protrusions which could damage the GCL. Do not place GCL prior to inspection and approval of subgrade by ENGINEER. Place and compact subgrade materials in accordance with SECTION 02210 EARTHWORK.
- B. Where the GCL is the sole barrier, subgrade surfaces consisting of gravel or granular soils may not be acceptable due to the large void content. The subgrade shall be greater than 80% fines and contain no particles larger than 1 inch. Provide and install a suitable cushion layer where needed.
- C. Immediately prior to installation of the GCL, compact the subgrade to fill in any remaining voids or desiccation cracks and to eliminate sharp irregularities or abrupt elevation changes. Maintain the subgrade in this condition and free of standing water.

### 3.4 INSTALLATION

- A. Notify ENGINEER a minimum of 10 days prior to installation of GCL. Install GCL to the lines and grades as shown on the Drawings.
- B. Immediately prior to installation remove the packaging carefully without damaging the GCL. Roll out and install the GCL in accordance with the GCL Installation Plan and as recommended by manufacturer, proceeding from highest elevation to lowest to facilitate drainage in the event of precipitation. Shingle panel layout and deployment with overlaps having the upstream panel shingled over downstream panel. Install all slope panels parallel to the maximum slope; panels in flat areas require no orientation.
- C. Install GCL rolls using proper spreader and rolling bars so that the GCL is not stretched during deployment. Avoid dragging the GCL. Use a slip-sheet to position the liner to protect GCL from underlying materials.
- D. If the GCL is prematurely hydrated to greater than 30% moisture, ENGINEER will determine whether the material is acceptable or if alternative measures must be taken to ensure the quality of the design. Remove and replace GCL which has been hydrated, as requested by ENGINEER, prior to being covered by an overlying geomembrane or cover soil. Hydrated GCL is defined as having become soft as determined by squeezing the material with finger pressure or material which has exhibited swelling.
- E. Only install as much GCL as can be covered by the end of the day. Do not leave GCL exposed overnight. Temporarily cover the exposed edge of the GCL with a tarpaulin or other such water resistant sheeting until the next working day.
- F. When tying into existing GCL, perform all excavation of previously installed GCL by hand to prevent damage.
- G. ENGINEER will inspect each panel, after placement and prior to seaming, for damage and/or defects. Replace or repair defective or damaged panels at no cost to OWNER.
- H. Anchor all GCL as shown on the Drawings and consistent with manufacturer's recommendations.
- I. If necessary, anchor the GCL down by weighting with 10-pound (minimum) sand bags placed at 1 bag every 9 square feet or as approved by ENGINEER. Weighting shall remain in place until replaced with cover material.

### 3.5 ANCHOR TRENCHES

- A. For an anchor trench excavated in cohesive soil susceptible to desiccation, excavate only the amount of anchor trench required for placement of GCL in a single day. Remove ponded water from the anchor trench while the trench is open.
- B. Round trench corners to avoid sharp bends in the GCL.

- C. Remove loose soil, rocks larger than 1/2-inch in diameter, and any other material which could damage the GCL from the surfaces of the trench.
- D. Extend the GCL down the front wall and across the bottom of the anchor trench.
- E. On gentle slopes or in locations where it is difficult to create an anchor trench, the GCL may be anchored by a material run-out past the crest of the slope, as approved by ENGINEER.
- F. Backfill and compact the anchor trench.

### 3.6 SEAMS

- A. On side slopes, place GCL with seams oriented parallel to the line of maximum slope and free of tension or stress upon completion of installation. Position panels with the overlap recommended by the manufacturer, but not less than 6 inches for panel sides or 18 inches for panel ends.
- B. Remove soil or other foreign matter from the overlap area immediately prior to seaming.
- C. If recommended by the manufacturer, place granular bentonite of the same type as the bentonite used for the GCL along the entire overlap width at a minimum rate of 0.25 pounds per linear foot or as recommended.
- D. Use construction adhesive or other approved seaming methods recommended by the manufacturer for horizontal seams on slopes.

### 3.7 PROTECTION

- A. Protect GCL during installation from equipment, rocks, excessive moisture, tears, and other damage.
- B. Do not allow equipment to remain on top of the installed GCL overnight. Remove and store all equipment away from the installed GCL.
- C. Vehicular traffic across the GCL is not allowed.
- D. Do not refuel equipment or allow fuel containers on top of or near the installed GCL.
- E. Personnel working on the GCL shall not smoke, wear damaging shoes, or perform any activity that may damage the GCL.
- F. Place a scrap geomembrane sheet underneath equipment necessary to perform the installation (generators, compressors, etc.) to protect the installed GCL from possible damage.

### 3.8 REPAIRS

- A. Repair rips or tears to the GCL on flat surfaces by completely exposing the affected area, removing all foreign objects or soil, and placing a patch cut from unused GCL over the damage with a minimum overlap of 12 inches on all edges or as recommend by manufacturer. Damaged material may be left in place under repair.
- B. Repair rips or tears to the GCL on slopes using the same procedures above. Adhere the edges of the patch to the repaired liner with a construction adhesive or other approved method as recommended by the manufacturer to keep the patch in position during backfill or cover operations.
- C. If recommended by the manufacturer, apply granular bentonite or bentonite mastic in the overlap area.

### 3.9 PENETRATIONS

- A. Penetration details shall be as recommended by the GCL manufacturer. As a minimum, incorporate a collar of GCL wrapped around the pipe and securely fasten for pipe penetrations.

- B. Place dry bentonite or bentonite paste around the penetration as recommended by the GCL manufacturer.

### 3.10 COVERING

Do not cover the GCL until it has been inspected and approved by ENGINEER.

#### 3.10.1 Cover Soil

- A. Install cover soil in a manner that prevents soil from entering the GCL overlap zone, tensile stress from being mobilized in the GCL, and wrinkles from folding over. Use equipment with ground pressures less than 7 pounds per square inch to place the first lift over the GCL. Do not use scrapers or pans directly over the GCL.
- B. Do not drive heavy vehicles onto the GCL until the proper thickness of cover is installed. Maintain a minimum thickness of 12 inches of cover between the GCL and heavy equipment.
- C. The initial lift(s) of soil cover shall not be compacted in excess of 85% Modified Proctor density or as specified by ENGINEER.
- D. In sloped areas, push cover soil up-slope to minimize tension on the GCL.
- E. Place riprap from the bottom of the slope upward and do not drop onto the GCL from a height greater than 1 foot.

#### 3.10.2 Geomembrane Cover

- A. Install a geomembrane cover in a manner that prevents damage to the GCL. Use lightweight, rubber-tired equipment such as a 4-wheel all-terrain vehicle (ATV) than can be driven directly on the GCL, provided the ATV makes no sudden stops, starts, or turns.
- B. Drag smooth geomembrane cover across the GCL surface with equipment or by hand during positioning. The geomembrane may be unrolled with the use of low ground pressure equipment.
- C. For a textured geomembrane, place a slip-sheet (such as 20-mil smooth HDPE) over the GCL in order to allow the geomembrane to slide into its proper position. Carefully remove the slip-sheet to avoid any movement to the geomembrane.

## SECTION 02900

### GROWTH MEDIA (COVER SOIL)

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This section covers all labor, supplies, materials, equipment, and incidentals necessary for Site development, excavation, stockpiling, hauling, depositing, spreading, and preparing for fertilizing and seeding all topsoil and subsoil material to be used as growth media at the Site in compliance with the Contract Documents.

##### 1.2 REFERENCES

Publications listed below are incorporated into this specification by reference.

**American Society of Agronomy, Inc. and Soil Science Society of America, Inc. (ASA/SSSA)**

ASA/SSSA                      Monograph No. 9 Methods of Soil Analysis, Parts 1-2

**U.S. Department of Agriculture (USDA)**

Natural Resources Conservation Service, Textural Soil Classification

**U.S. Environmental Protection Agency (EPA)**

EPA Method 600/2-78-054      Field and Laboratory Methods Applicable to Overburdens and Minesoils

EPA SW-846                      Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

##### 1.3 SUBMITTALS

**Imported Growth Media Product Information**

- A. Provide and submit the source site location including detailed mapping no later than 10 days prior to Work involving growth media.
- B. Provide and submit copies of all laboratory and field test reports within 24 hours of receipt of the test results. Laboratory testing of at least 3 soil samples from source area collected in presence of ENGINEER. Sample locations and depth determined by ENGINEER.
- C. Soil parameters include the following parameters, or as specified in the Special Provisions using USDA classification and test methods as described in ASA/SSSA Monograph No. 9, except for lead and arsenic which shall be analyzed using EPA SW-846:
  1. Texture class and particle size.
  2. pH
  3. Saturation percent.
  4. Conductivity (EC) in mmhos/cm.
  5. Percent organic matter.
  6. Available nitrogen (NO<sub>3</sub>), phosphorus (P), and potassium (K).
  7. Metals.

- D. Provide and submit analyses of the exchangeable sodium percentage (ESP) as requested by ENGINEER when pH is greater than 8.0, when EC is greater than 2.0 and mean annual precipitation is less than 19 inches, or where sodic soils are known to exist. ESP shall be analyzed using methods described in ASA/SSSA Monograph No. 9. Acid-base accounting (ABA) shall be analyzed where the soil source is in known mineralized areas and in accordance with EPA-600/2-78-054.

## 1.4 DEFINITIONS

### 1.4.1 Topsoil

Topsoil is defined as natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than 1 inch in diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Usually the upper, outermost layer of soil containing the highest concentration of organic matter and microorganisms and is where most of the biological soil activity occurs (A Horizon Material).

### 1.4.2 Growth Media

Topsoil (A Horizon Material) and subsoil (B Horizon Material) meeting all textural, physical, and chemical requirements shall be considered growth media after it has been excavated.

## PART 2 PRODUCTS

### 2.1 GROWTH MEDIA

#### 2.1.1 On-Site Growth Media

Topsoil and subsoil to be used as growth media shall be reasonably free of trash, rocks, and hard lumps of soil, stumps, or brush. Remove and dispose of noxious weeds prior to stripping topsoil. Suitable topsoil shall contain sod or soils with large amounts of humus and other organic materials to promote plant growth. Obtain approval from ENGINEER for the suitability of the subsoil as growth media. Stockpile suitable soil separately from unsuitable soil in a manner to prevent erosion or contamination.

#### 2.1.2 Imported Growth Media

- A. Imported growth media shall be fertile, friable material of an organic composition and characterized as loam, sandy loam, sandy clay loam, clay loam, silty clay loam, or silt loam in accordance with the USDA textural classification. Growth media shall be reasonably free of trash, rocks, and hard lumps of soil, stumps, and brush. Proposed imported growth media source shall be free of noxious weeds; Growth media from a source site with noxious weeds will be rejected. Clay textured soils with more than 40% clay are unsuitable for use.
- B. Imported growth media shall meet the requirements in Table 1.

TABLE 1- IMPORTED GROWTH MEDIA GRADATION REQUIREMENTS		
Fraction	Particle Size (mm)	Maximum % of Soil (-10 Mesh) Fraction
Sand	0.05 - 2.0	70
Silt	0.002 - 0.05	70
Clay	Less than 0.002	40
Gravel	Larger than 2.0	Max. % of total sample <sup>1</sup>

<sup>1</sup>A maximum of 20% of the total soil sample is allowable; however, any quantity greater than 10% will not be included in the basis for payment.

- C. Imported growth media pH shall be between 5.5 and 8.0. The maximum pH limit may be extended to 8.5 if the soil ESP is less than 10. The ESP shall not be greater than 15%. Soil saturation percent shall be less than 85% and greater than 25%.
- D. Imported growth media shall have EC less than 4 milliSiemens per centimeter (mS/cm).
- E. The organic content shall be not less than 1.5%.
- F. ABA shall indicate that no acid-forming materials are present (i.e., net neutralizing).

## **PART 3 EXECUTION**

### **3.1 SITE DEVELOPMENT**

Complete Site development including clearing and grubbing as necessary in accordance with SECTION 02120 CLEARING AND GRUBBING to prepare the borrow area for topsoil and subsoil excavation. Remove and dispose of refuse in accordance with SECTION 02213 DEBRIS AND STRUCTURE DISPOSAL.

### **3.2 TOPSOIL AND SUBSOIL EXCAVATION AND STOCKPILING**

- A. Excavate and salvage topsoil and subsoil from the borrow area in separate operations, where practical, to the depths specified or as requested by ENGINEER.
- B. Strip and stockpile the first lift, comprised of the existing upper 6 inches of topsoil, unless a thinner or thicker lift is requested by ENGINEER.
- C. Separately strip the second lift, comprised of the underlying subsoil.
- D. Stockpile the first lift (topsoil) and second lift (subsoil) in separate piles. Locate the stockpiles where they will not impair drainage. Shape and smooth stockpiles to facilitate measurement of the piles.
- E. Install BMPs and sediment controls at the stockpile locations as described in the Erosion and Sediment Control Plan and requested by ENGINEER.
- F. Removal of growth media, including excavation and stockpile, is separate from other excavation related to the Project. Exercise care to avoid the incorporation of any deleterious subsoil or mine waste materials.
- G. ENGINEER will determine the amount of stripped topsoil to be left at the borrow area for borrow area reclamation.

### **3.3 IMPORTED GROWTH MEDIA**

Pay all costs involved, including royalties, permits, and other costs for developing the growth media source, including borrow site reclamation. Costs shall be included in the Bid and no separate payment will be made.

### **3.4 GROWTH MEDIA PLACEMENT (ALL SOURCES)**

- A. Place growth media after the areas to be covered have been properly prepared and all Work in the area has been completed and approved by ENGINEER.
- B. Roughen the surface of all slopes to receive growth media and scarify smooth slopes perpendicular to the slope to facilitate holding the growth media in place.

- C. Break up ordinary sod or soil containing grass roots before placement of topsoil such that 90% of the mass of the sod or soil can pass through a 2-inch sieve opening prior to placement; screening is not required. ENGINEER may request additional efforts to break up excessive sod masses.
- D. Place and spread growth media to the lift thicknesses specified in the Contract Documents.
- E. Do not over compact the vegetative backfill. For areas which have been compacted by multiple passes of equipment, rip the surface to a depth of 12 inches using rippers that are spaced no further than 18 inches apart.
- F. After the cover soil has been spread and prior to seeding, remove and dispose of all large clods, hard lumps, rocks, and large roots (over 6 inches in diameter), litter or other foreign material (exposed scrap iron, timbers, etc.). The cover soil shall be brought to a friable condition via agricultural methods (disking or an approved alternative) to an average depth of 4 inches, or as specified by ENGINEER.
- G. Do not place growth media in areas of standing water, excessively wet or muddy areas, or over snow.

### 3.5 SITE RECLAMATION

Grade the growth media borrow site to blend with existing contours and provide positive drainage following completion of topsoil and subsoil removal. Replace and spread stockpiled topsoil evenly over the borrow area as approved by ENGINEER.

## **APPENDIX C**

### **DESIGN ANALYSIS SUPPORTING INFORMATION**



**10-ACRE POND CONTAMINANTS OF CONCERN  
CONCENTRATION SUMMARY**

### 10-Acre Pond – August 2017 Pond Water Results

Site COC	COC Concentrations in Pond Water (µg/L)	Tapwater RSL (µg/L) <sup>1</sup>	Project Screening Level (µg/L) <sup>2</sup>	EPA WQC (µg/L) <sup>3</sup>	Avian (µg/L) <sup>4</sup>
Molybdenum	175,000 – 253,000	100	180	---	15,040
Vanadium	24,800 – 32,300	86	260	---	48,989
Manganese	7,870 – 11,700	430	180	---	4,284,000
Arsenic	75 – 311	0.52	50	150 (0.14)	10,600

Notes:

1. Regional Screening Levels (RSLs) for tapwater (EPA, 2017a)
2. Project Screening Levels (PSLs) from ROD Risk-Based Groundwater Performance Standards (EPA, 1995)
3. EPA freshwater chronic and human health fish ingestion (in parenthesis) (Water Quality Criteria [WQC])
4. Risk-based screening level for rough-winged swallow drinking water (i.e. exposure through the food chain is not considered) (Sample et al., 1996)

EPA. 1995. Record of Decision, Kerr-McGee, Soda Springs, September 28.

EPA. 2017a. “Regional Screening Levels (RSLs) – Generic Tables (June 2017).”

<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>

EPA. 2017b. “National Recommended Water Quality Criteria– Human Health Criteria Table (Accessed October 25, 2017).”

<https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table>

### 10-Acre Pond – August 2017 Sediment Results

Site COC	COC Concentration (mg/kg)	Industrial Soil SSL (mg/kg) <sup>1</sup>	Protection of Groundwater Risk-Based SSL (mg/kg) <sup>2</sup>
Molybdenum	29,900	5,800	2
Vanadium	30,700	5,800	86
Manganese	725	26,000	280
Arsenic	7	3.0	0.0015

Notes:

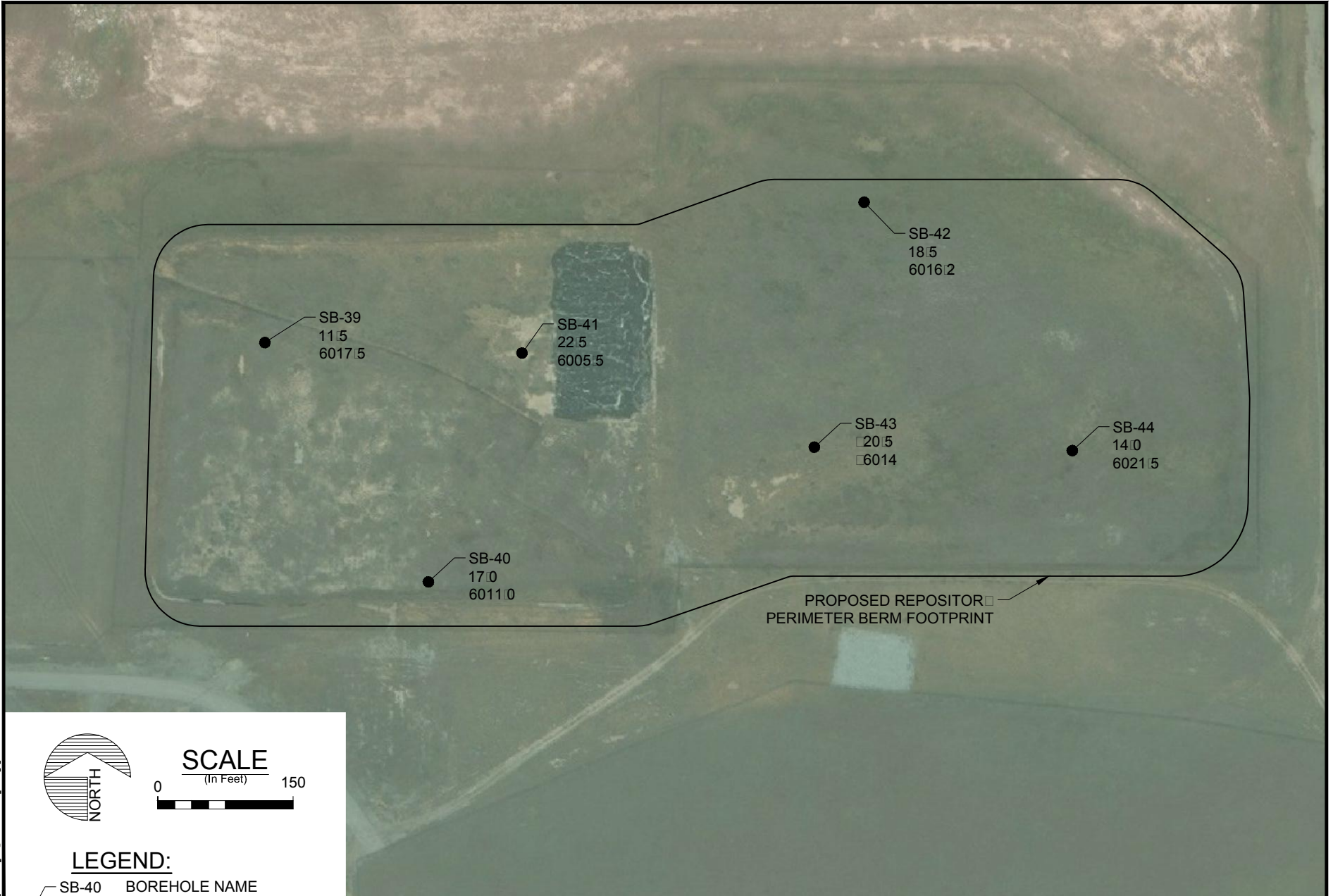
1. EPA Regional Screening Levels (RSLs) for Industrial Soil; Last revised June 2017 (EPA, 2017a)
2. EPA RSL for Protection of Groundwater; Last revised June 2017 (EPA, 2017a)

EPA. 2017a. “Regional Screening Levels (RSLs) – Generic Tables (June 2017).”

<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017>

Tables duplicated from TCAM

**BOREHOLE DATA FOR THE 5-ACRE PONDS AREA**



LEGEND:		
SB-40	BOREHOLE NAME	
17.0	DEPTH TO BEDROCK	
6011.0	ESTIMATED BEDROCK ELEVATION	
BOREHOLE LOCATIONS APPROXIMATE		

2018 10-ACRE POND REMOVAL ACTION WORK PLAN	PHASE II BOREHOLE LOCATIONS	FIGURE
		C-1

## BORING LOG

PROJECT NAME: Soot Sprints  
PROJECT NUMBER: \_\_\_\_\_  
DRILLING COMPANY: Clement  
DRILLING RIG: DM Probe

BORING No.: 515-~~21~~ 39  
DATE: 9-27-2016  
GEOLOGIST: D. Shaffer  
DRILLER: Craig Clement

[illegible]

\* When rock coring, enter rock brokenness.

**\*\* Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.**

Remarks: MST-SB3901(1005)(6.0-7.0)  
MST-SB3902(1015)(12.0-14.0)

Drilling Area  
Background (ppm):

Converted to Well: Yes \_\_\_\_\_ No \_\_\_\_\_ Well I.D. #: \_\_\_\_\_







## Page \_\_\_\_ of \_\_\_\_

BORING No.: SR-41  
DATE: 9/27/2016  
GEOLOGIST: D. Shaffer  
DRILLER: Cram

\* When rock coring, enter rock brokenness.

**\*\* Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.**

Remarks:

### Drilling Area

**Background (ppm):**

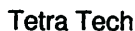
**Converted to Well:**

**Yes**

**No**

Well I.D. #:

105-354401 (1050) (5.8-7.3)  
105-354402 (1065) (120-145)



## Page of

PROJECT NAME: SOA SERVICES  
PROJECT NUMBER: \_\_\_\_\_  
DRILLING COMPANY: Clement  
DRILLING RIG: ASM Probe

BORING No.: SB-412  
DATE: 9/27/2016  
GEOLOGIST: D. Shaffer  
DRILLER: Cvara

[illegible]

\*\* Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Remarks: MST-5B4201 (6.0-7.5) (1150)  
MST-5B4202 (12.0-14.0) (1200)

Drilling Area  
Background (ppm):

<b>Converted to Well:</b>	<b>Yes</b>	<b>No</b>	<b>Well I.D. #.</b>
---------------------------	------------	-----------	---------------------





Tetra Tech

**BORING LOG**

Page \_\_\_\_ of \_\_\_\_

PROJECT NAME: SARA SPGS  
 PROJECT NUMBER: \_\_\_\_\_  
 DRILLING COMPANY: Clement  
 DRILLING RIG: ASM Probe

BORING No.: SB-43  
 DATE: 9/27/2016  
 GEOLOGIST: D. Shafer  
 DRILLER: Craig

Sample No. and Type or RQD	Depth (FL) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/FL) or Screened Interval	MATERIAL DESCRIPTION			U S C S *	Remarks	PID/FID Reading (ppm)			
					Soil Density/ Consistency or Rock Hardness	Color	Material Classification			Sample	Sampler BZ	Borehole**	Driller BZ**
	0.0		1.2		Soft	BR	SILT, soft	ML	soft, color change at 1.2'				
	1.2		3.0		Fract	TAN	SILT	ML	darkens @ 2.5'				
	3.0		4.0		NR	-							
	4.0		6.1		Sl dense	BR	SILT, dk brown	ML	sl. dense, dry, color change @ 6.1				
	6.1		7.2		Sl dense	BR	SILT, mottled	ML	sl. dense, sl. calcified				
	7.2		8.0		NR	-							
	8.0		10.5		Sl Dense	BR	SILT	ML	sl. mottled, sl. dense				
	10.5		12.0		Sl Dense	BR	SILT, w/ fn sand	ML/SM	color change from above				
	12.0		14.0		NR	-							
	14.0		16.6		Sl Dense	BR	SILT w/ fn sand	ML/SM	med. well-sorted				
	16.6		18.0		Dark	BR	SILT w/ u. fn. sand	ML/SM	dense, brown, damp, clayey.				
	18.0		19.5		NR	-							
	19.5		20.5		Sl Dense	BR	SILT, some basalt frags	ML	color change at 19.5'				
					Very Dense	BR	SILT, sandy, fn sand	ML	very dense, mottled, hard drill.				

\* When rock coring, enter rock brokenness.

\*\* Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Remarks: MST-SB-4301 (6.0-7.2)  
MST-SB-4302 (12-14)  
EXPLORATION

Drilling Area  
 Background (ppm):

Converted to Well: Yes ☐ No ☐ Well I.D. #:



**WEST CALCINE AREA**  
**LABORATORY SOILS TESTING RESULTS**



2018 10-ACRE POND REMOVAL ACTION  
WORK PLAN

**WEST CALCINE TEST PIT LOCATIONS**

**FIGURE**

**C-2**



April 17, 2017

Mr. Joel Gerhart  
Pioneer Technical Services  
201 E Broadway Ste C  
Helena, MT 59601

**RE: KMCC Soda Springs Plant-Site Demolition**

Dear Mr. Gerhart,

On February 19, soil samples from the KMCC Soda Springs project were delivered to our ASTM/AASHTO accredited materials testing laboratory. The samples were given Lab Nos. 20996 through 21042. The testing request was performed in general accordance with:

- Sieve Analysis of Coarse and Fine Aggregate (ASTM C136, C117);
- Standard Proctor Moisture/Density Relationships (ASTM D698 Method C);
- Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318) and
- Moisture Content of Soil (ASTM D2216).

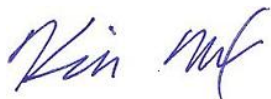
The testing results for Moisture Content are presented in Table 1.

**Table 1 –Moisture Content**

Lab No.	Boring	Depth (ft)	Moisture Content (%)
20996	TP-01	3.5	19.4
20997	TP-01	6	21.5
20998	TP-02	3.5	17.7
20999	TP-02	6	19.6
21000	TP-03	3.6	24.8
21001	TP-03	6.5	22.4
21002	TP-04	3.5	23.2
21003	TP-04	6.6	25.6
21004	TP-05	Cover Soil	17.8
21005	TP-05	2.6	17.4
21006	TP-05	8	24.2
21008	TP-06	Cover Soil	44.7
21009	TP-06	3.6	10.6
21010	TP-06	10.7	23.1
21011	TP-07	3.5-4	19.9
21040	TP-08	4	21.6

The grain-size distribution, Atterberg Limits charts, and the Proctor curves are included with this report. We thank you for using Pioneer Technical Services, Inc. for your geotechnical and materials testing requirements. If you have any questions regarding these results, please contact Kevin Mock at (406) 443-6053.

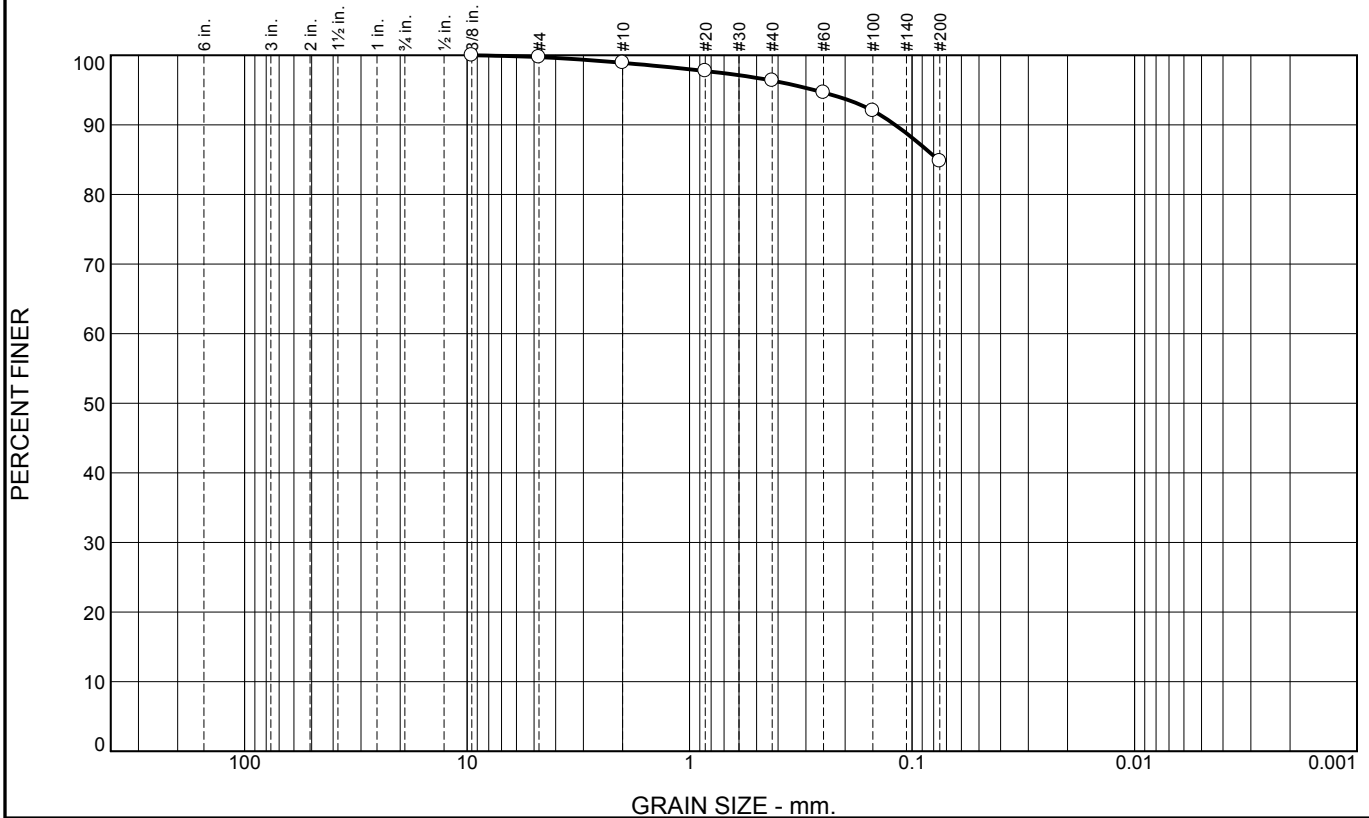
Sincerely,  
PIONEER TECHNICAL SERVICES, INC.

A handwritten signature in blue ink, appearing to read "Kevin Mock", is written over the printed name.

Kevin Mock  
*Materials Testing Supervisor*



# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	1	3	11	85	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100		
#4	100		
#10	99		
#20	98		
#40	96		
#60	95		
#100	92		
#200	85		

\* (no specification provided)

**Material Description**

**Atterberg Limits**  
 PL=      LL=      PI=

**Coefficients**  
 D<sub>90</sub>= 0.1191      D<sub>85</sub>= 0.0762      D<sub>60</sub>=  
 D<sub>50</sub>=      D<sub>30</sub>=      D<sub>15</sub>=  
 D<sub>10</sub>=      C<sub>u</sub>=      C<sub>c</sub>=

**Classification**  
 USCS=      AASHTO=

**Remarks**

Location: TP-05; West Calcine Area  
 Sample Number: 21004      Depth: 1' Cover Soil

Date: 2-19-18

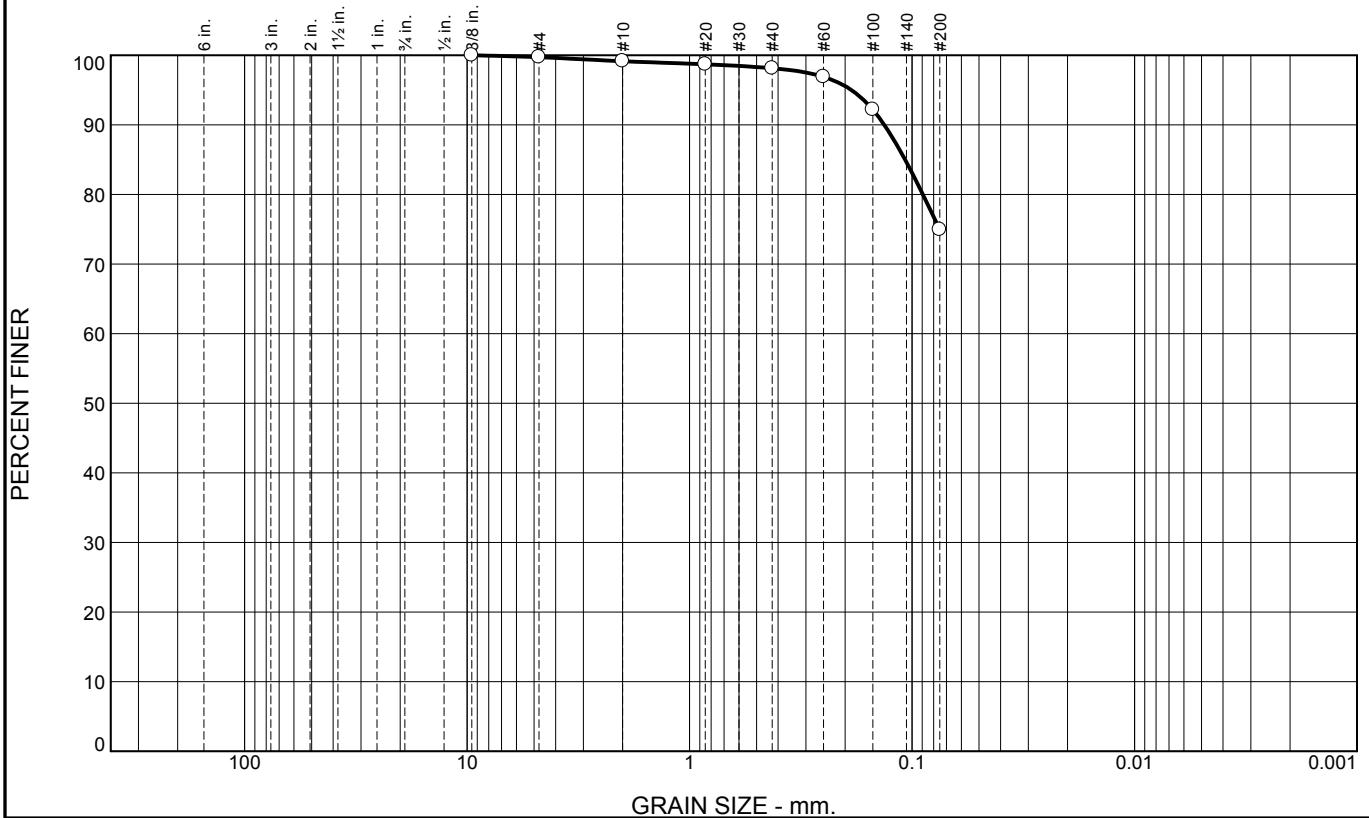


Client: Hydrometrics  
 Project: KMCC Soda Springs Plant

Project No: Site Demolition

Figure

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	1	1	23	75	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100		
#4	100		
#10	99		
#20	99		
#40	98		
#60	97		
#100	92		
#200	75		

\* (no specification provided)

## Material Description

PL=      **Atterberg Limits**      PI=

LL=

**Coefficients**

D<sub>90</sub>= 0.1332      D<sub>85</sub>= 0.1075      D<sub>60</sub>=

D<sub>50</sub>=      D<sub>30</sub>=      D<sub>15</sub>=

D<sub>10</sub>=      C<sub>u</sub>=      C<sub>c</sub>=

**Classification**

USCS=      AASHTO=

**Remarks**

**Location:** TP-05; West Calcine Area  
**Sample Number:** 21005      **Depth:** 2.6 Pure Calcine

**Date:** 2-19-18



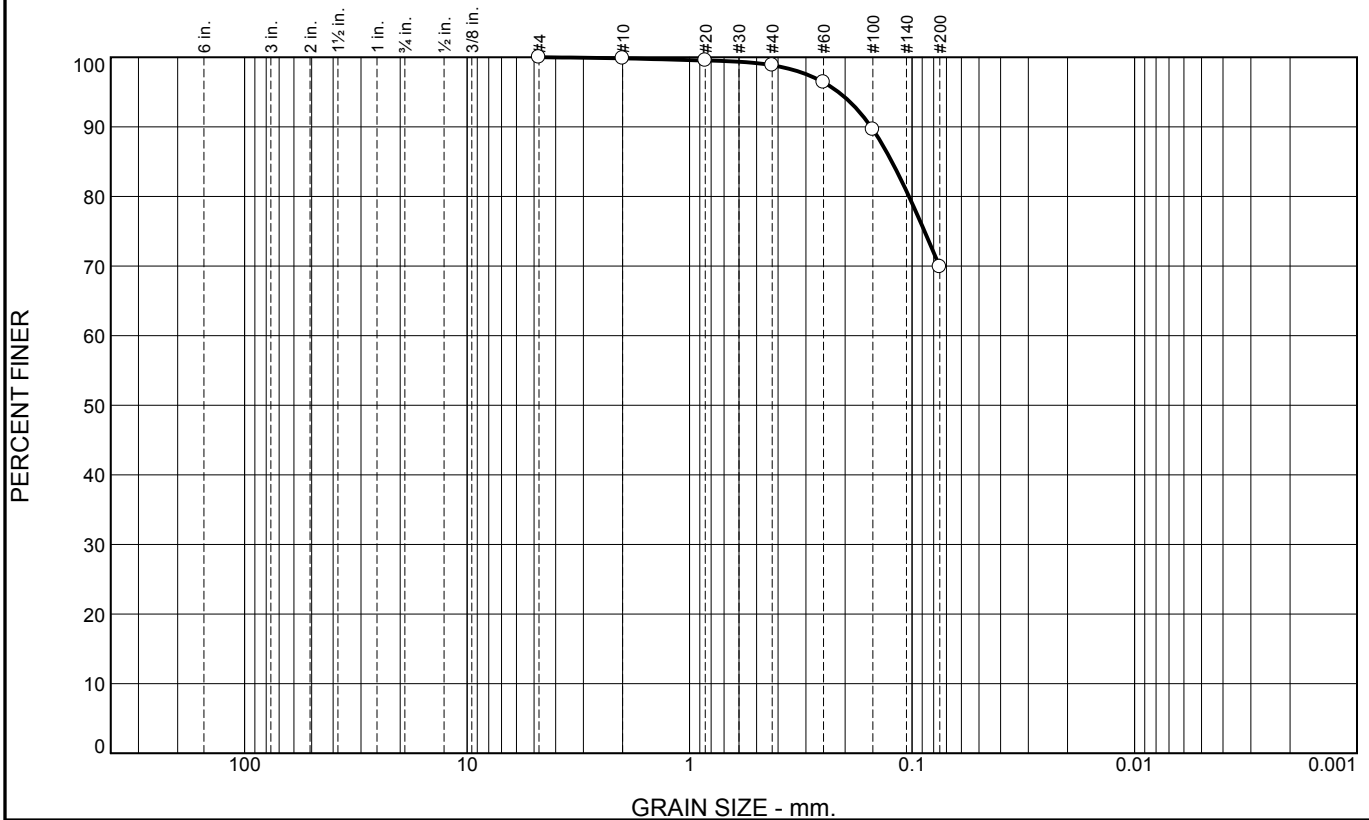
**Client:** Hydrometrics  
**Project:** KMCC Soda Springs Plant

**Project No:** Site Demolition

**Figure**



# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	1	29	70	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100		
#10	100		
#20	100		
#40	99		
#60	96		
#100	90		
#200	70		

\* (no specification provided)

**Material Description**

**Atterberg Limits**  
 PL=      LL=      PI=

**Coefficients**  
 D<sub>90</sub>= 0.1528      D<sub>85</sub>= 0.1232      D<sub>60</sub>=  
 D<sub>50</sub>=      D<sub>30</sub>=      D<sub>15</sub>=  
 D<sub>10</sub>=      C<sub>u</sub>=      C<sub>c</sub>=

**Classification**  
 USCS=      AASHTO=

**Remarks**

Location: TP-05; West Calcine Area  
 Sample Number: 21006      Depth: 8' Pure Calcine

Date: 2-19-18

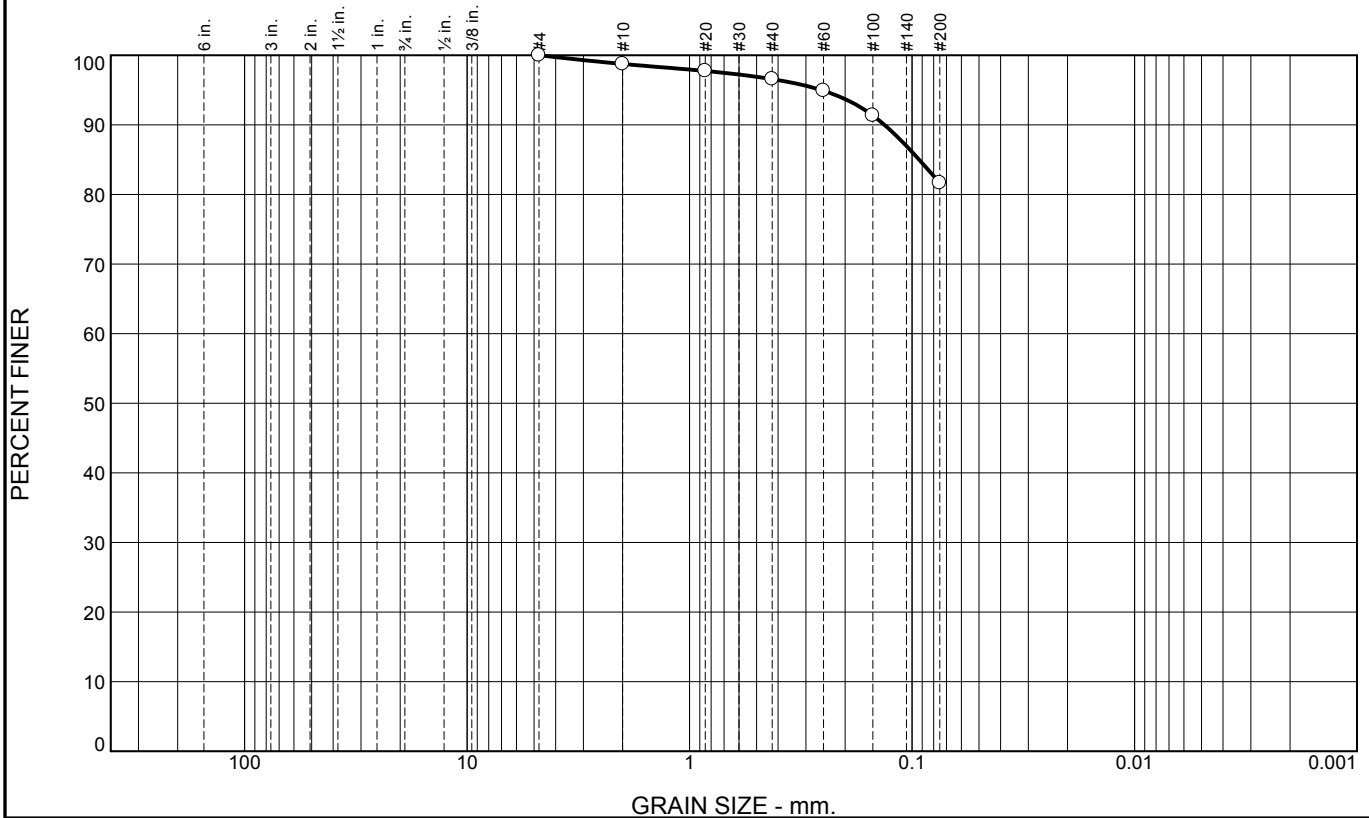


Client: Hydrometrics  
 Project: KMCC Soda Springs Plant

Project No: Site Demolition

Figure

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	1	2	15	82	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100		
#10	99		
#20	98		
#40	97		
#60	95		
#100	91		
#200	82		

\* (no specification provided)

**Material Description**

**Atterberg Limits**  
 PL=      LL=      PI=

**Coefficients**  
 D<sub>90</sub>= 0.1331      D<sub>85</sub>= 0.0929      D<sub>60</sub>=  
 D<sub>50</sub>=      D<sub>30</sub>=      D<sub>15</sub>=  
 D<sub>10</sub>=      C<sub>u</sub>=      C<sub>c</sub>=

**Classification**  
 USCS=      AASHTO=

**Remarks**

Location: TP-06; West Calcine Area  
 Sample Number: 21008      Depth: 0.5' Cover Soil

Date: 2-19-18

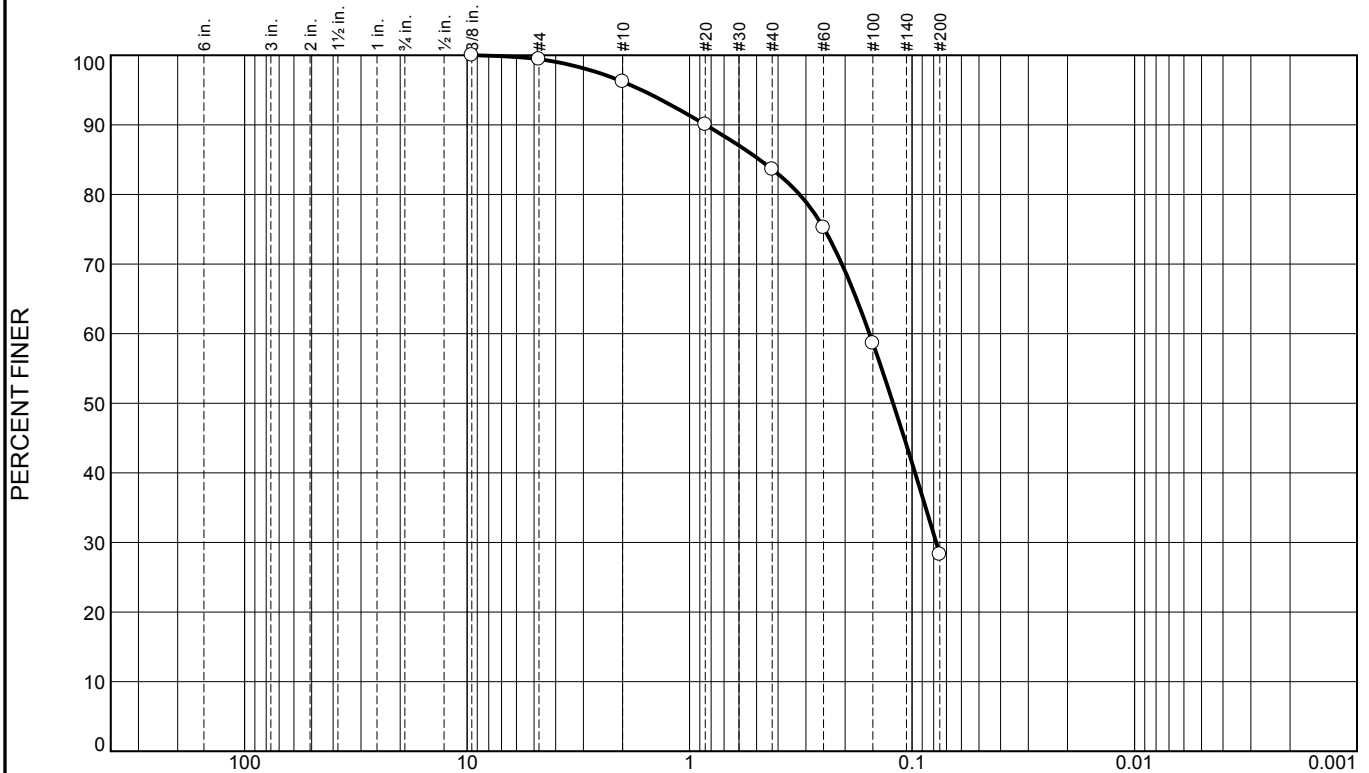


Client: Hydrometrics  
 Project: KMCC Soda Springs Plant

Project No: Site Demolition

Figure

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	3	12	56	28	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100		
#4	99		
#10	96		
#20	90		
#40	84		
#60	75		
#100	59		
#200	28		

\* (no specification provided)

## Material Description

PL=      **Atterberg Limits**      LL=      PI=

**Coefficients**

D<sub>90</sub>= 0.8477      D<sub>85</sub>= 0.4851      D<sub>60</sub>= 0.1553

D<sub>50</sub>= 0.1216      D<sub>30</sub>= 0.0778      D<sub>15</sub>=

D<sub>10</sub>=      C<sub>u</sub>=      C<sub>c</sub>=

**Classification**

USCS=      AASHTO=

**Remarks**

**Location:** TP-06; West Calcine Area  
**Sample Number:** 21009      **Depth:** 3.6' Pure Calcine

**Date:** 2-19-18

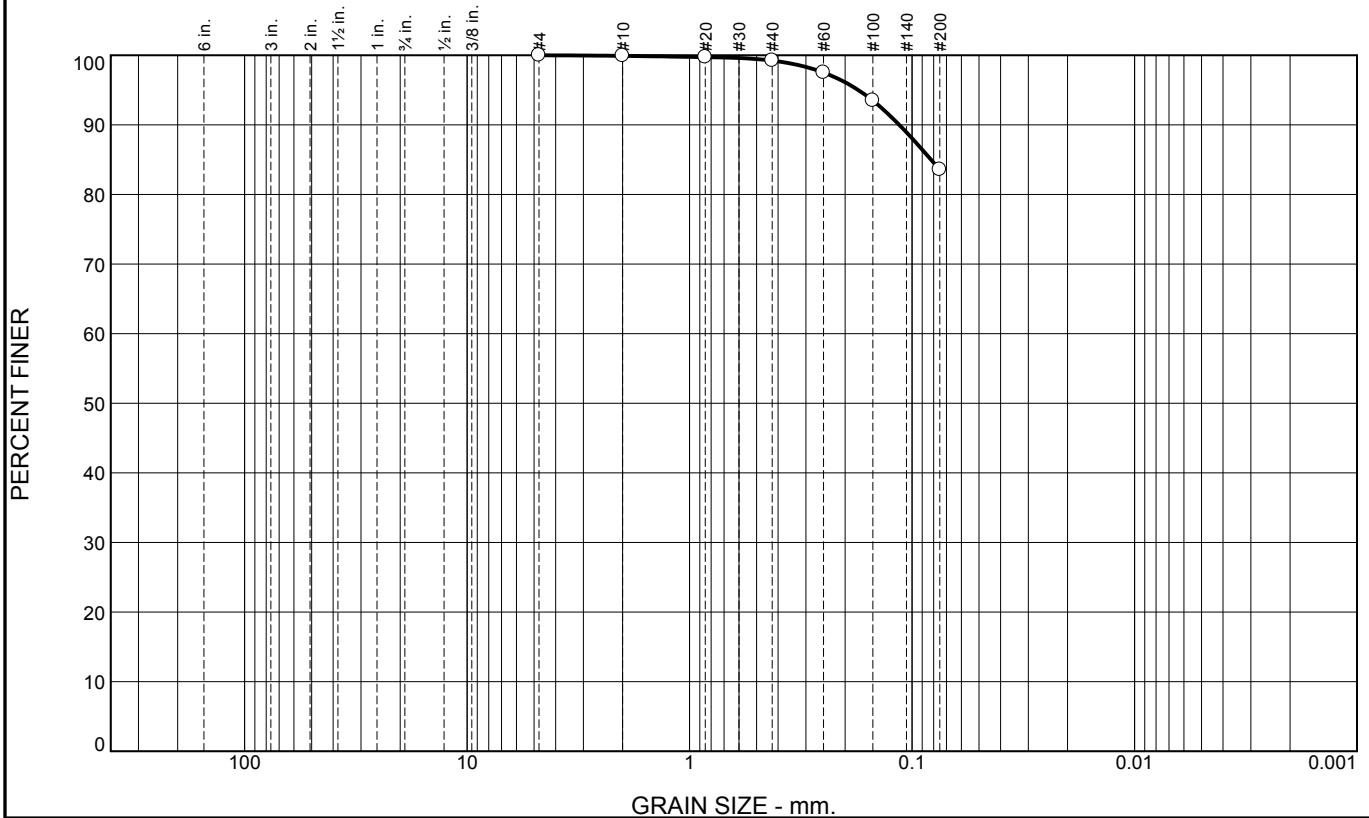


**Client:** Hydrometrics  
**Project:** KMCC Soda Springs Plant

**Project No:** Site Demolition

**Figure**

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	1	15	84	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100		
#10	100		
#20	100		
#40	99		
#60	98		
#100	93		
#200	84		

\* (no specification provided)

**Material Description**

**Atterberg Limits**  
 PL=      LL=      PI=

**Coefficients**  
 D<sub>90</sub>= 0.1141      D<sub>85</sub>= 0.0821      D<sub>60</sub>=  
 D<sub>50</sub>=      D<sub>30</sub>=      D<sub>15</sub>=  
 D<sub>10</sub>=      C<sub>u</sub>=      C<sub>c</sub>=

**Classification**  
 USCS=      AASHTO=

**Remarks**

Location: TP-06; West Calcine Area  
 Sample Number: 21010      Depth: 10.7 Native

Date: 2-19-18

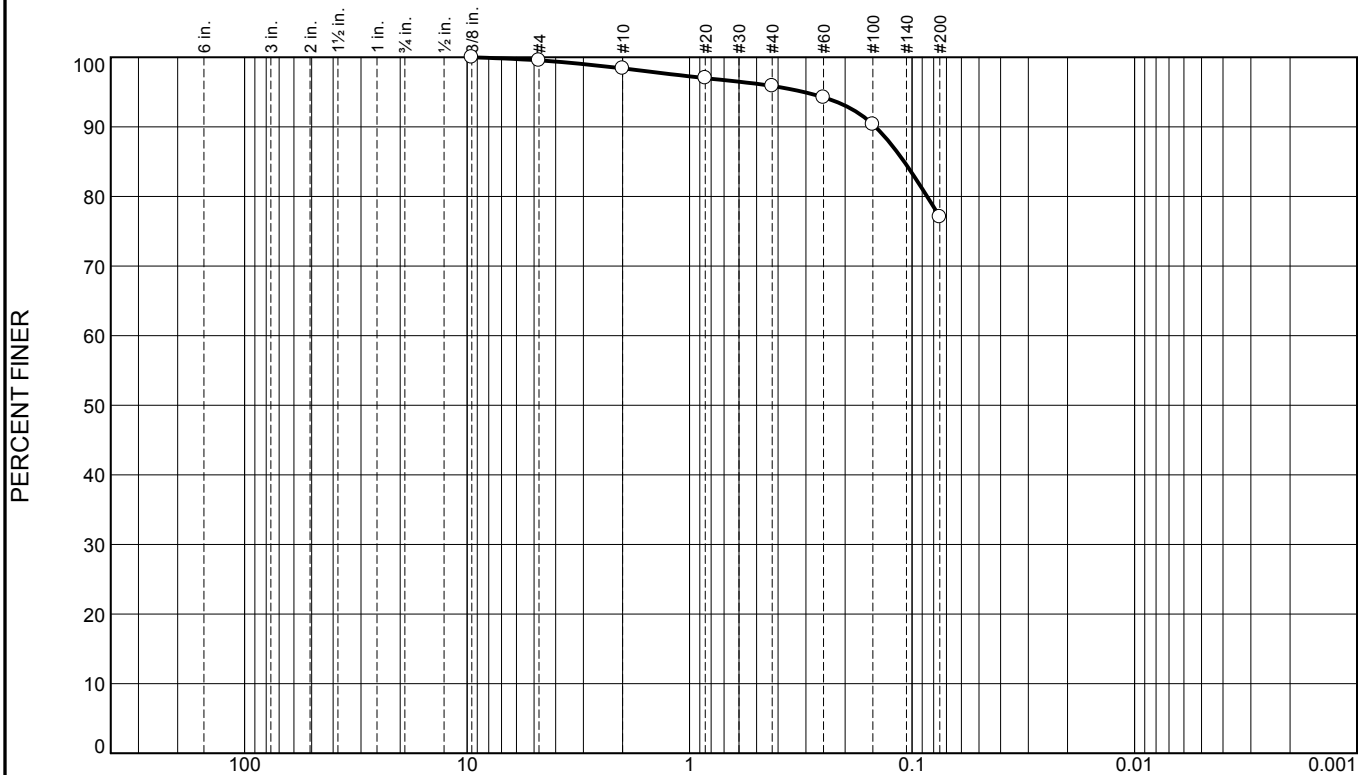


Client: Hydrometrics  
 Project: KMCC Soda Springs Plant

Project No: Site Demolition

Figure

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	2	2	19	77	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100		
#4	100		
#10	98		
#20	97		
#40	96		
#60	94		
#100	90		
#200	77		

\* (no specification provided)

## Material Description

PL=      **Atterberg Limits**      LL=      PI=

**Coefficients**

D<sub>90</sub>= 0.1460      D<sub>85</sub>= 0.1086      D<sub>60</sub>=

D<sub>50</sub>=      D<sub>30</sub>=      D<sub>15</sub>=

D<sub>10</sub>=      C<sub>u</sub>=      C<sub>c</sub>=

USCS=      **Classification**      AASHTO=

**Remarks**

**Location:** TP-07; West Calcine Area  
**Sample Number:** 21011      **Depth:** 3.5-4' Pure Calcine

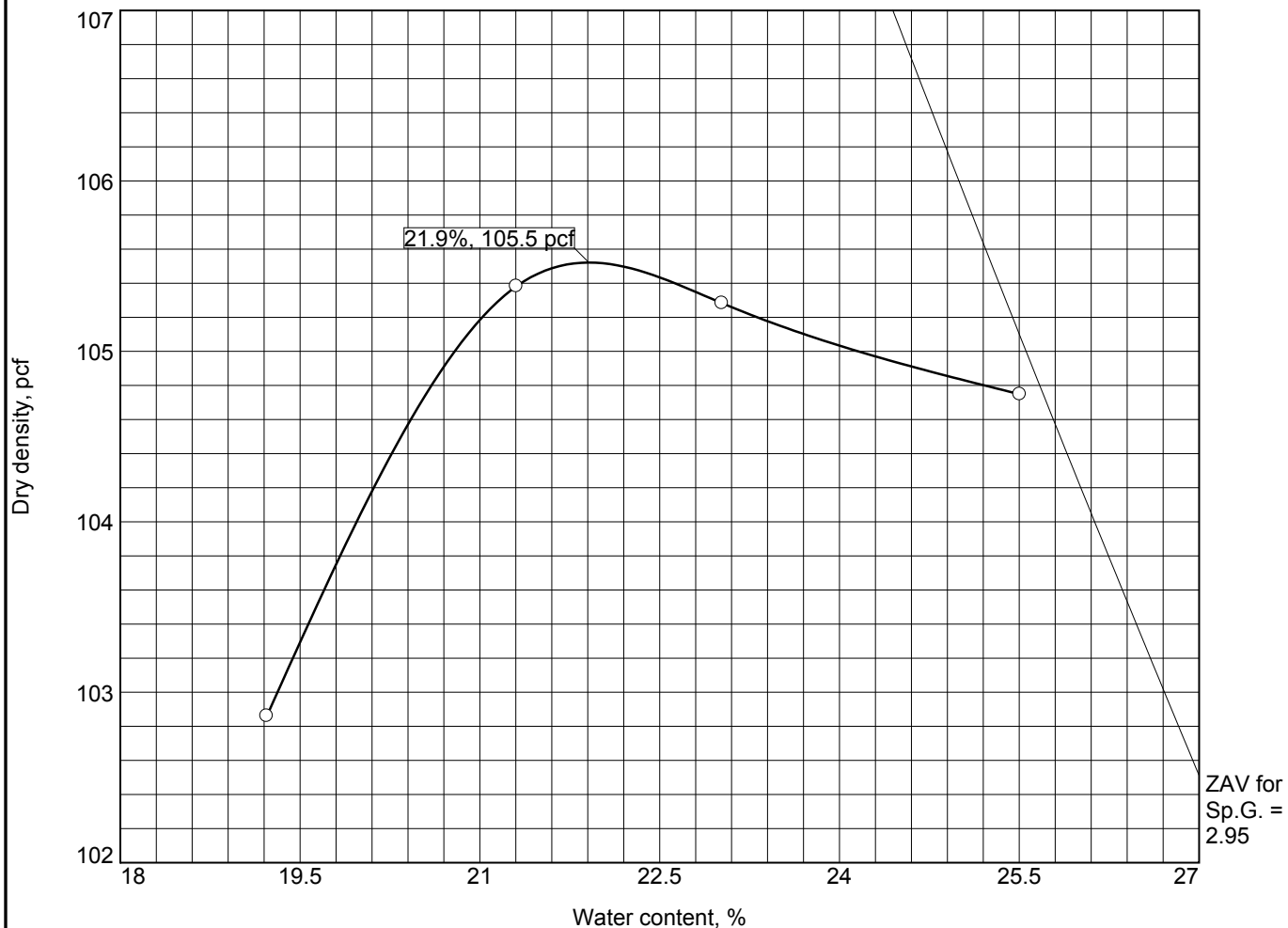
**Date:** 2-19-18



**Client:** Hydrometrics  
**Project:** KMCC Soda Springs Plant

**Project No:** Site Demolition

**Figure**



Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
2.6' Pure Calcine					NV	NP		

TEST RESULTS		MATERIAL DESCRIPTION	
Maximum dry density = 105.5 pcf  Optimum moisture = 21.9 %			
<b>Project No.</b> Site Demolition <b>Client:</b> Hydrometrics <b>Project:</b> KMCC Soda Springs Plant  <b>Date:</b> 2-19-18  <input type="radio"/> <b>Location:</b> TP-05 West Calcine Area <b>Sample Number:</b> 21021		<b>Remarks:</b>   <	

Figure

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	6	14	4	17	28	31	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100		
1.5"	98		
1"	96		
3/4"	94		
1/2"	90		
3/8"	87		
#4	80		
#10	76		
#20	68		
#40	59		
#60	51		
#100	43		
#200	31		

\* (no specification provided)

<u>Material Description</u>		
silty sand with gravel		
<u>Atterberg Limits</u>		
PL= NP	LL= NV	PI= NP
<u>Coefficients</u>		
D <sub>90</sub> = 12.3114	D <sub>85</sub> = 7.7366	D <sub>60</sub> = 0.4504
D <sub>50</sub> = 0.2292	D <sub>30</sub> =	D <sub>15</sub> =
D <sub>10</sub> =	C <sub>u</sub> =	C <sub>c</sub> =
<u>Classification</u>		
USCS= SM	AASHTO= A-2-4(0)	
<u>Remarks</u>		

Location: TP-05 West Calcline Area  
 Sample Number: 21022 Depth: 8.4-8.9' Native

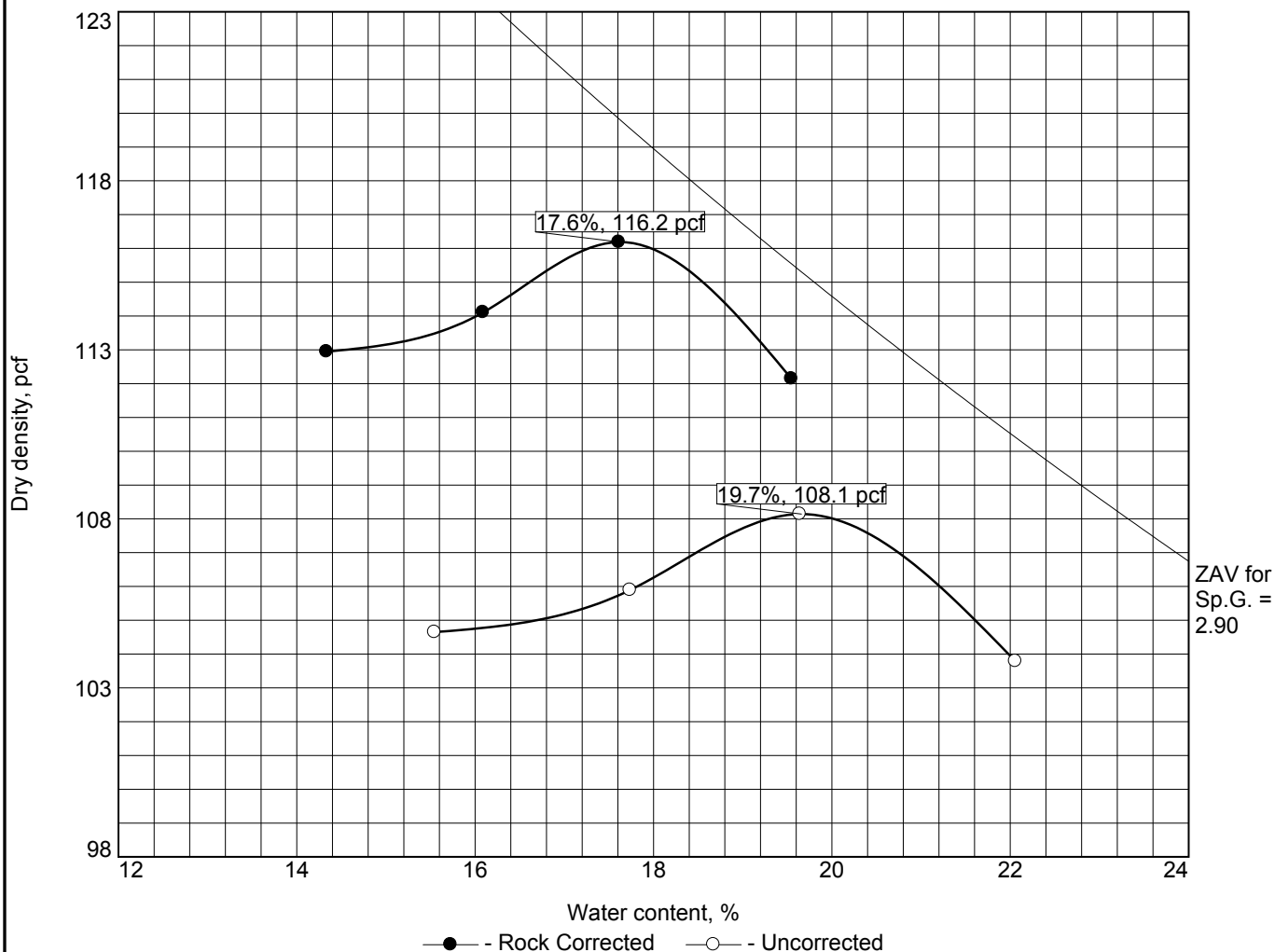
Date: 02-19-18



Client: Hydrometrics  
 Project: KMCC Soda Springs Plant


Project No: Site Demolition

Figure



Test specification: ASTM D 698-91 Procedure A Standard  
 ASTM D4718-15 Oversize Corr. Applied to Each Test Point

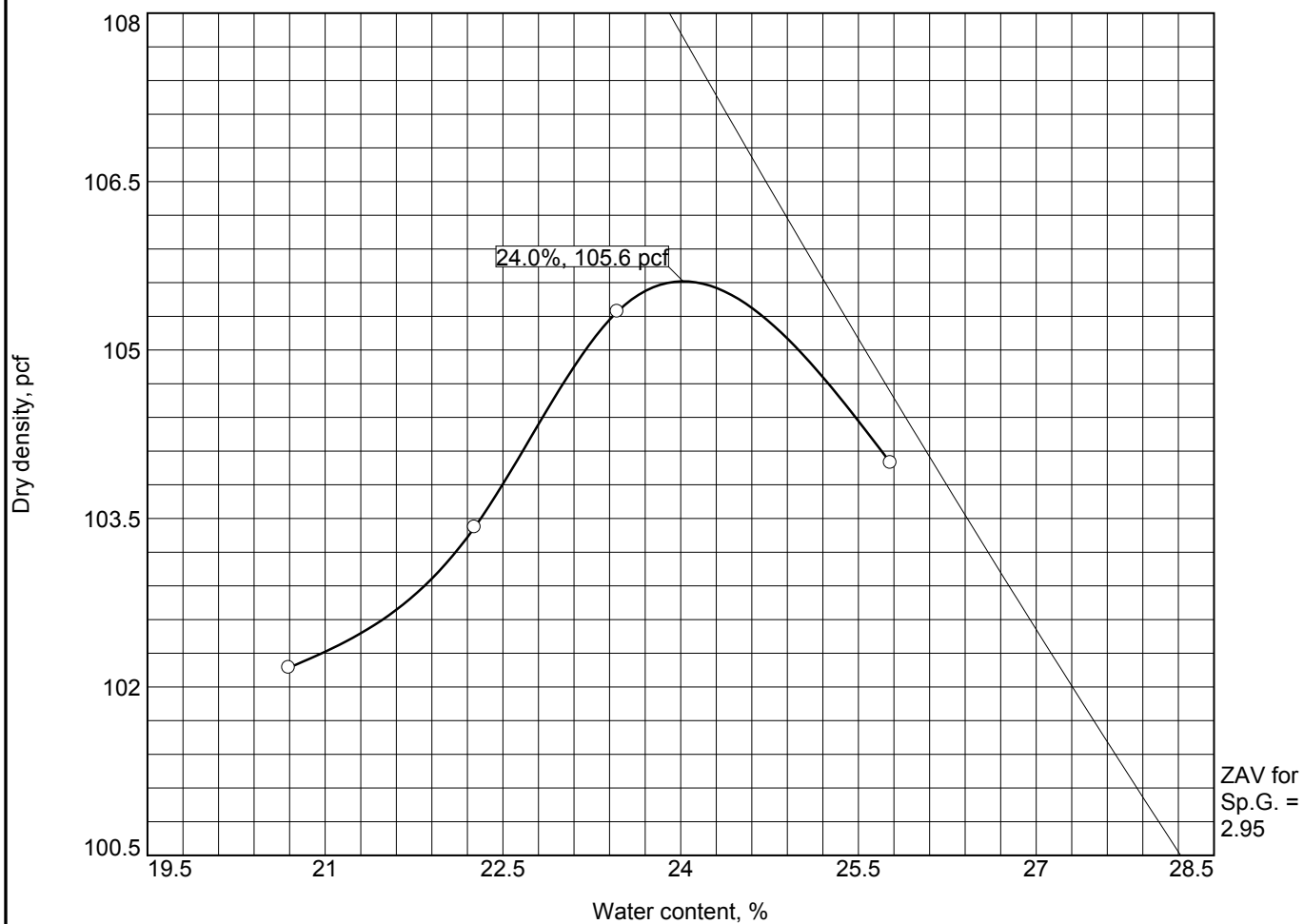
Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
8.4-8.9' Native	SM	A-2-4(0)			NV	NP	20	31

ROCK CORRECTED TEST RESULTS		UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 116.2 pcf		108.1 pcf	silty sand with gravel
Optimum moisture = 17.6 %		19.7 %	
<b>Project No.</b> Site Demolition <b>Client:</b> Hydrometrics <b>Project:</b> KMCC Soda Springs Plant <div>Date: 2-19-18</div> <div>Location: TP-05 West Calcine Area    Sample Number: 21022</div>			<b>Remarks:</b>
<div></div>			

Figure


Figure



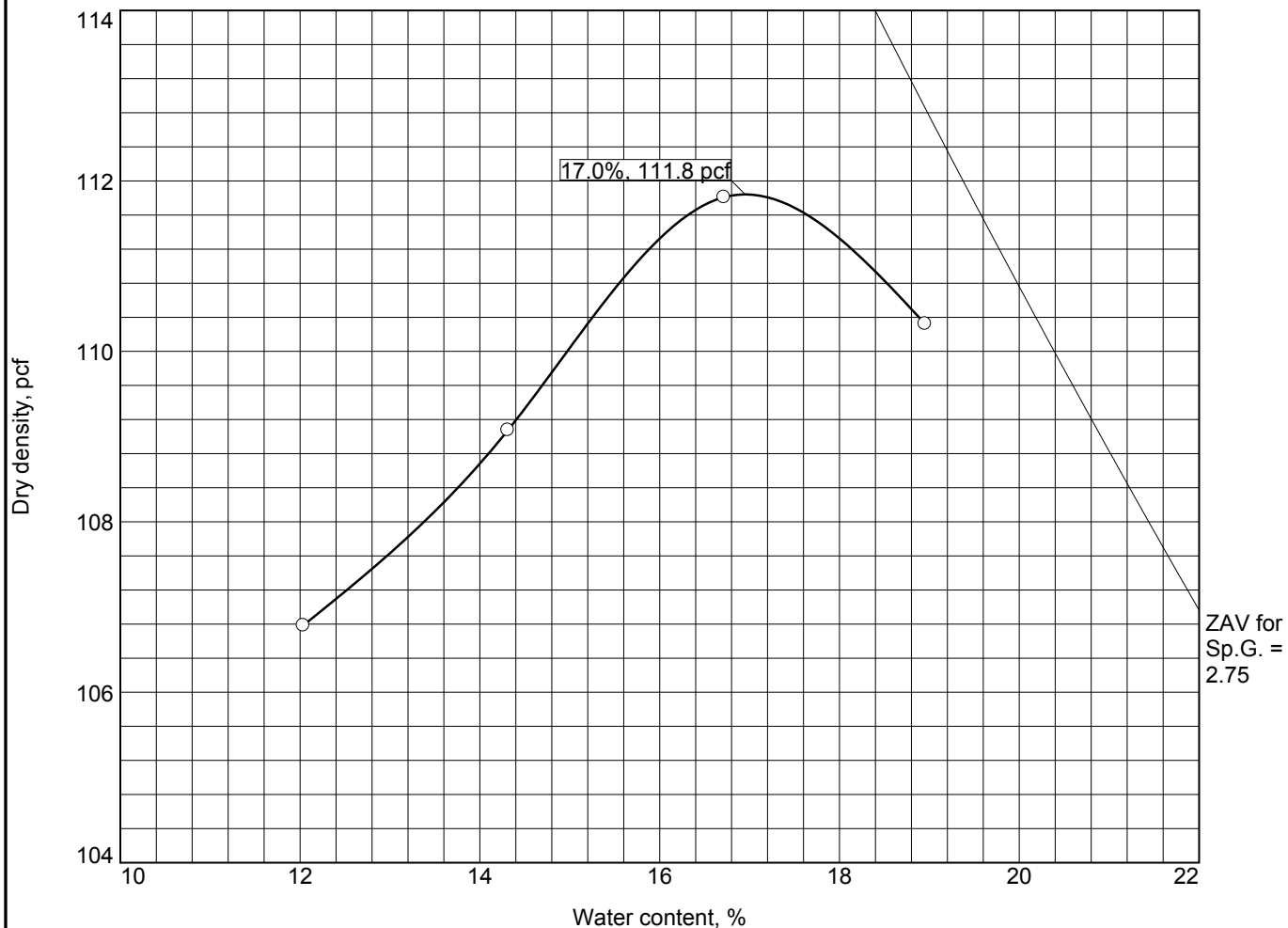


Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
3.6' Pure Calcine					NV	NP		

TEST RESULTS		MATERIAL DESCRIPTION	
Maximum dry density = 105.6 pcf Optimum moisture = 24.0 %			
<b>Project No.</b> Site Demolition <b>Client:</b> Hydrometrics <b>Project:</b> KMCC Soda Springs Plant <div><b>Date:</b>   2-19-18</div> <div><input type="radio"/> <b>Location:</b>   TP-06; West Calcine Area        <b>Sample Number:</b>   21024</div>		<b>Remarks:</b>	
<div></div>			
		<b>Figure</b>	

Figure

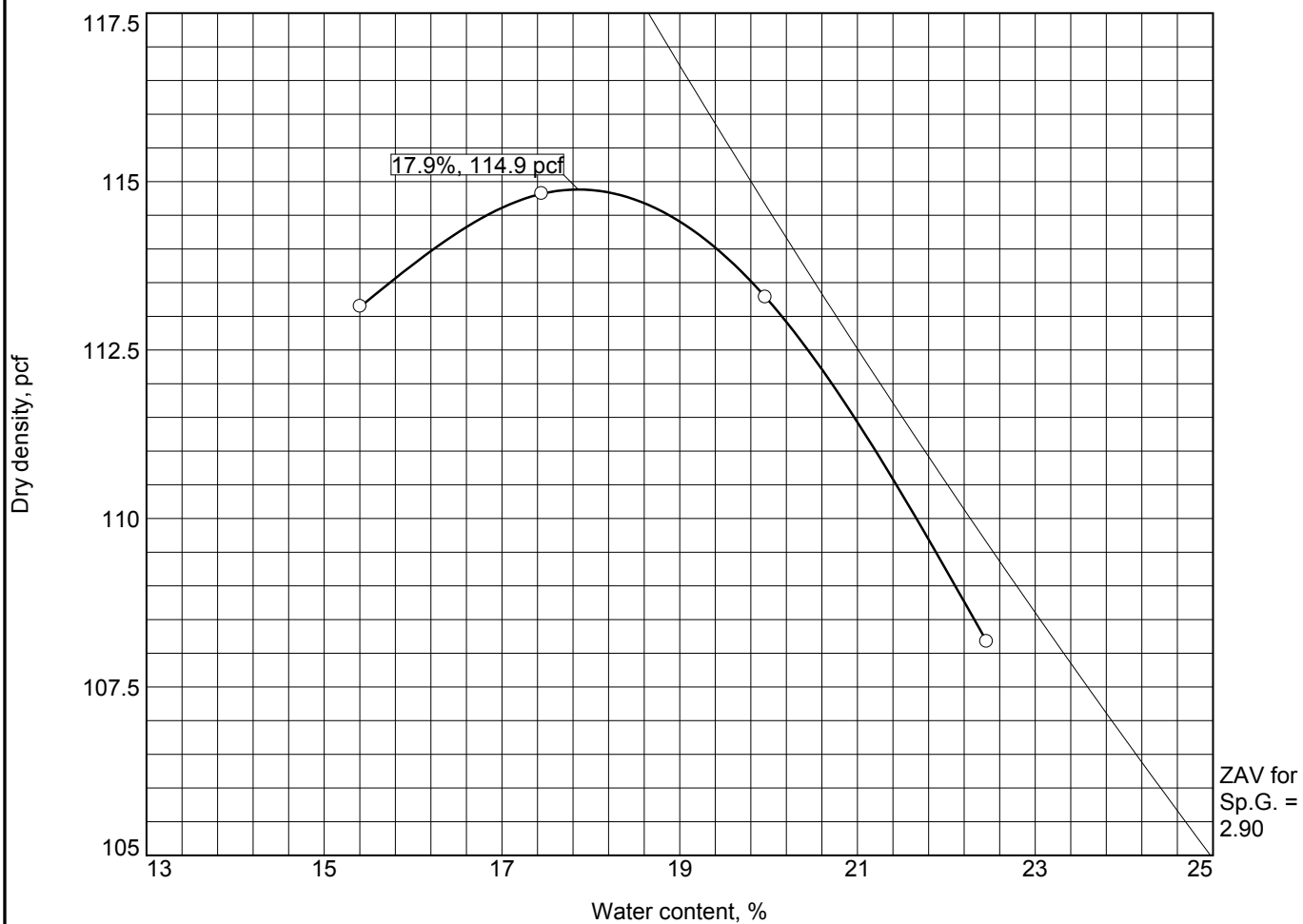


Test specification: ASTM D 698-91 Procedure A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
10.7' Native					25	4		


TEST RESULTS		MATERIAL DESCRIPTION
Maximum dry density = 111.8 pcf  Optimum moisture = 17.0 %		
<b>Project No.</b> Site Demolition <b>Client:</b> Hydrometrics <b>Project:</b> KMCC Soda Springs Plant  <div>Date: 2-19-18</div> <div><input type="radio"/> <b>Location:</b> TP-06; West Calcine Area      <b>Sample Number:</b> 21025</div>		<b>Remarks:</b>  <

Figure



Test specification: ASTM D 698-91 Procedure A Standard

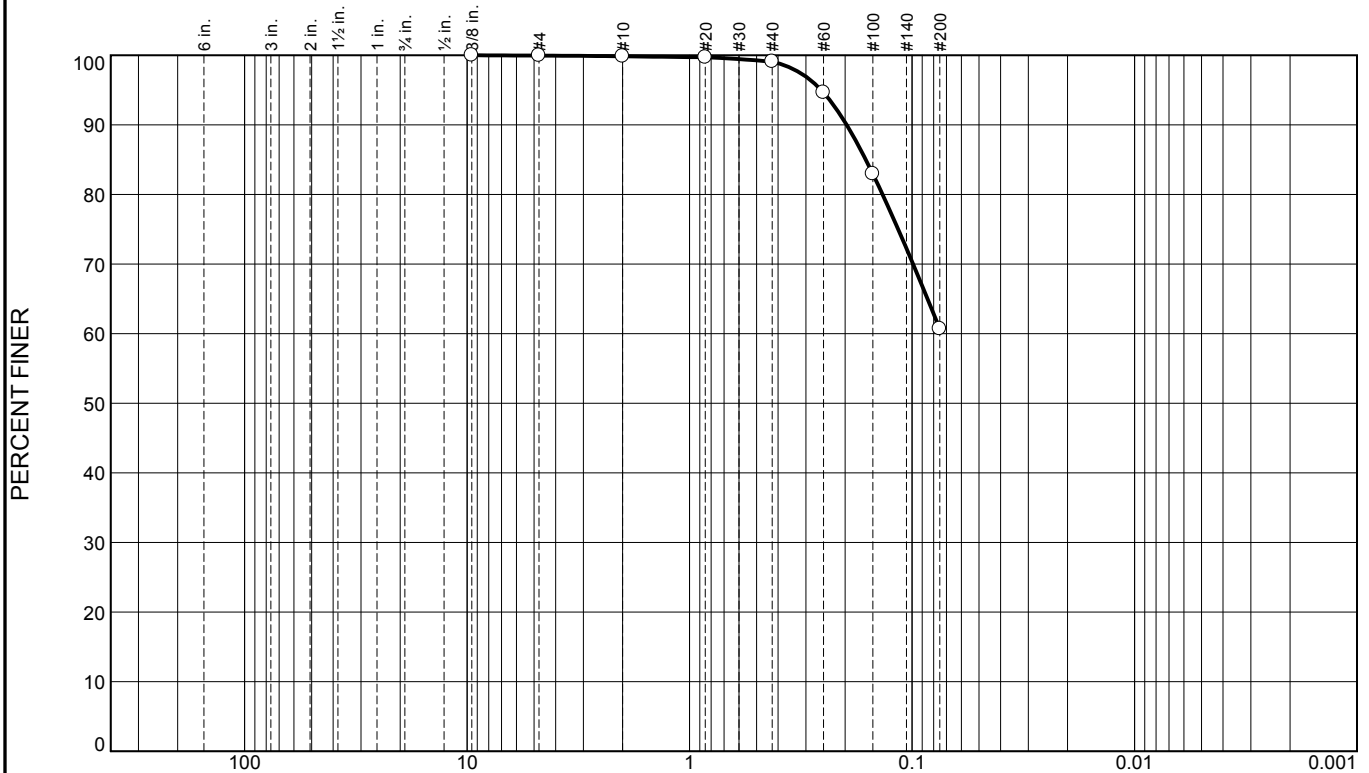
Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
3.5'-4' Pure Calcine					NV	NP		

TEST RESULTS		MATERIAL DESCRIPTION
Maximum dry density = 114.9 pcf  Optimum moisture = 17.9 %		
<b>Project No.</b> Site Demolition <b>Client:</b> Hydrometrics <b>Project:</b> KMCC Soda Springs Plant  <b>Date:</b> 2-19-18  <b>Location:</b> TP-07; West Calcine Area <b>Sample Number:</b> 21026		<b>Remarks:</b>
		

Figure

Figure

# Particle Size Distribution Report



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	0	1	38	61	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100		
#4	100		
#10	100		
#20	100		
#40	99		
#60	95		
#100	83		
#200	61		

\* (no specification provided)

## Material Description

**Atterberg Limits**  
 PL=      LL=      PI=  
**Coefficients**  
 D<sub>90</sub>= 0.1968      D<sub>85</sub>= 0.1615      D<sub>60</sub>=  
 D<sub>50</sub>=      D<sub>30</sub>=      D<sub>15</sub>=  
 D<sub>10</sub>=      C<sub>u</sub>=      C<sub>c</sub>=  
**Classification**  
 USCS=      AASHTO=  
**Remarks**

**Location:** TP-08; West Calcine Area  
**Sample Number:** 21040      **Depth:** 4' Pure Calcine

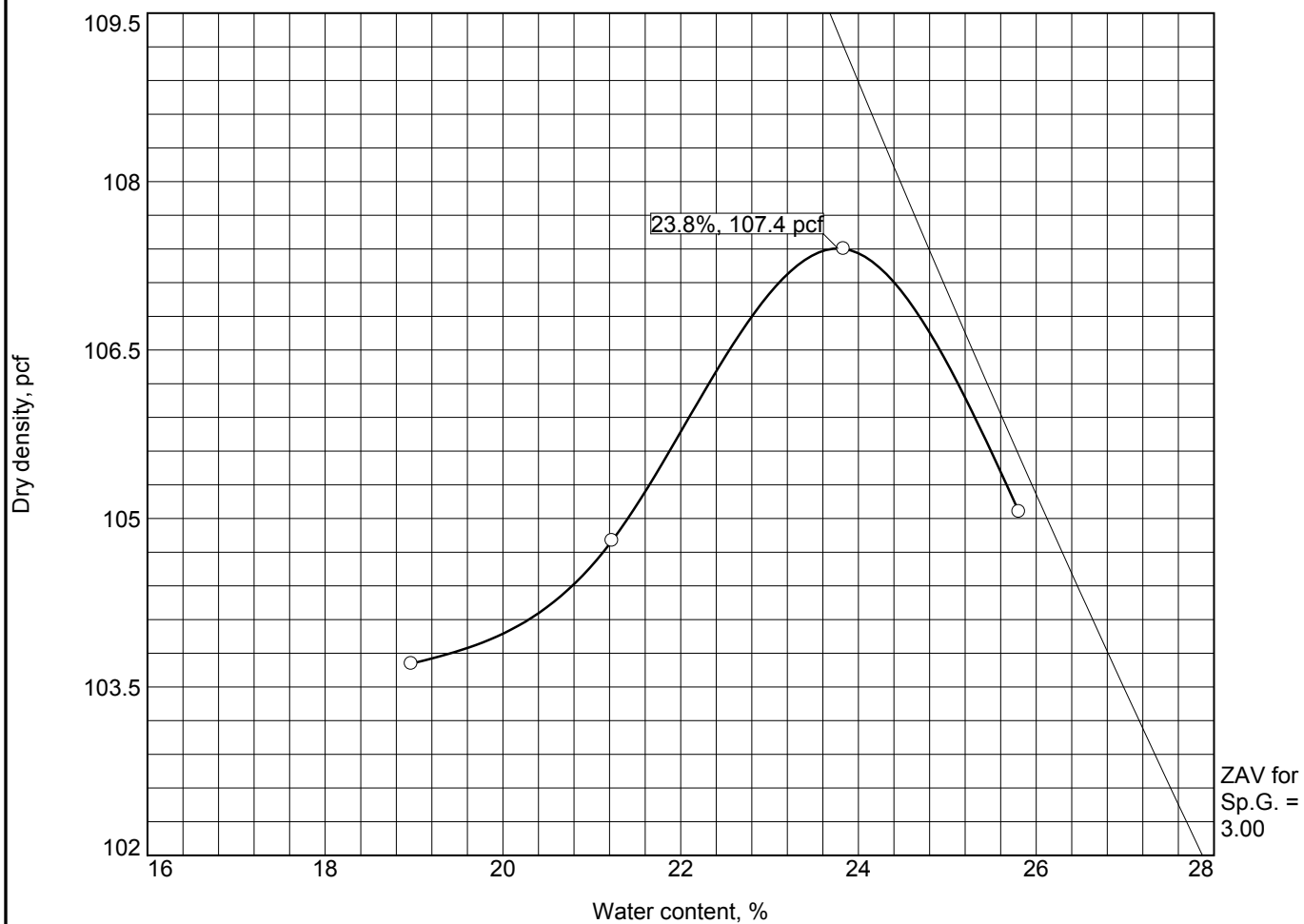
**Date:** 2-20-18



**Client:** Hydrometrics  
**Project:** KMCC Soda Springs Plant

**Project No:** Site Demolition

**Figure**

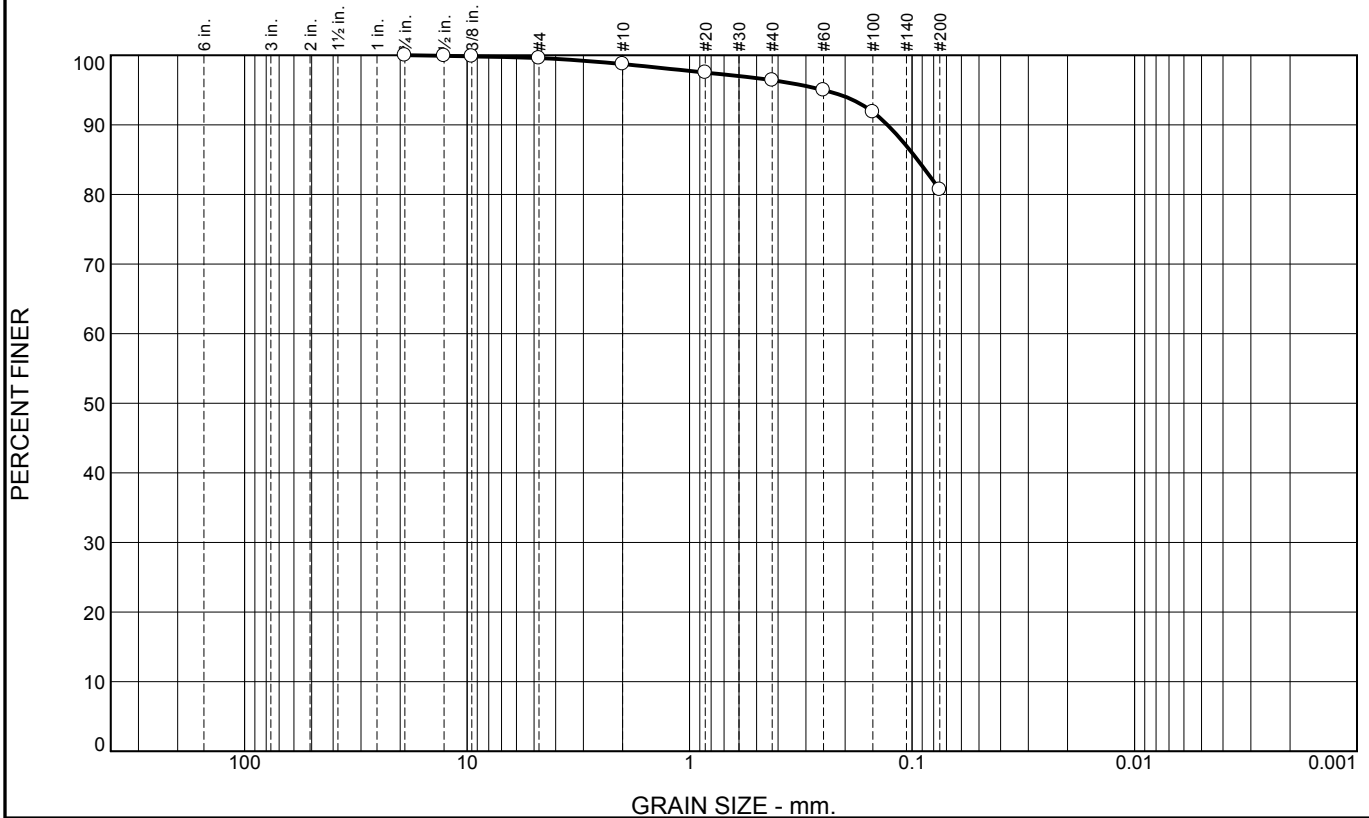


Test specification: ASTM D 698-12 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
1.5' Cover Soil					NV	NP		

TEST RESULTS		MATERIAL DESCRIPTION
Maximum dry density = 107.4 pcf  Optimum moisture = 23.8 %		
<b>Project No.</b> Site Demolition <b>Client:</b> Hydrometrics <b>Project:</b> KMCC Soda Springs Plant  <b>Date:</b> 2-20-18  <input type="radio"/> <b>Location:</b> TP-08; West Calcine Area <b>Sample Number:</b> 21042		<b>Remarks:</b>  <

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	1	3	15	81	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100		
1/2"	100		
3/8"	100		
#4	100		
#10	99		
#20	98		
#40	96		
#60	95		
#100	92		
#200	81		

\* (no specification provided)

## Material Description

silt with sand

## Atterberg Limits

PL= NP

LL= NV

PI= NP

## Coefficients

D<sub>90</sub>= 0.1290

D<sub>85</sub>= 0.0946

D<sub>60</sub>=

D<sub>50</sub>=

D<sub>30</sub>=

D<sub>15</sub>=

D<sub>10</sub>=

C<sub>u</sub>=

C<sub>c</sub>=

## Classification

USCS= ML

AASHTO= A-4(0)

## Remarks

Location: TP-05 West Calcine Area; Cover soil and Calcine Composite  
Sample Number: 21020-21021 Depth: 1' and 2.6'

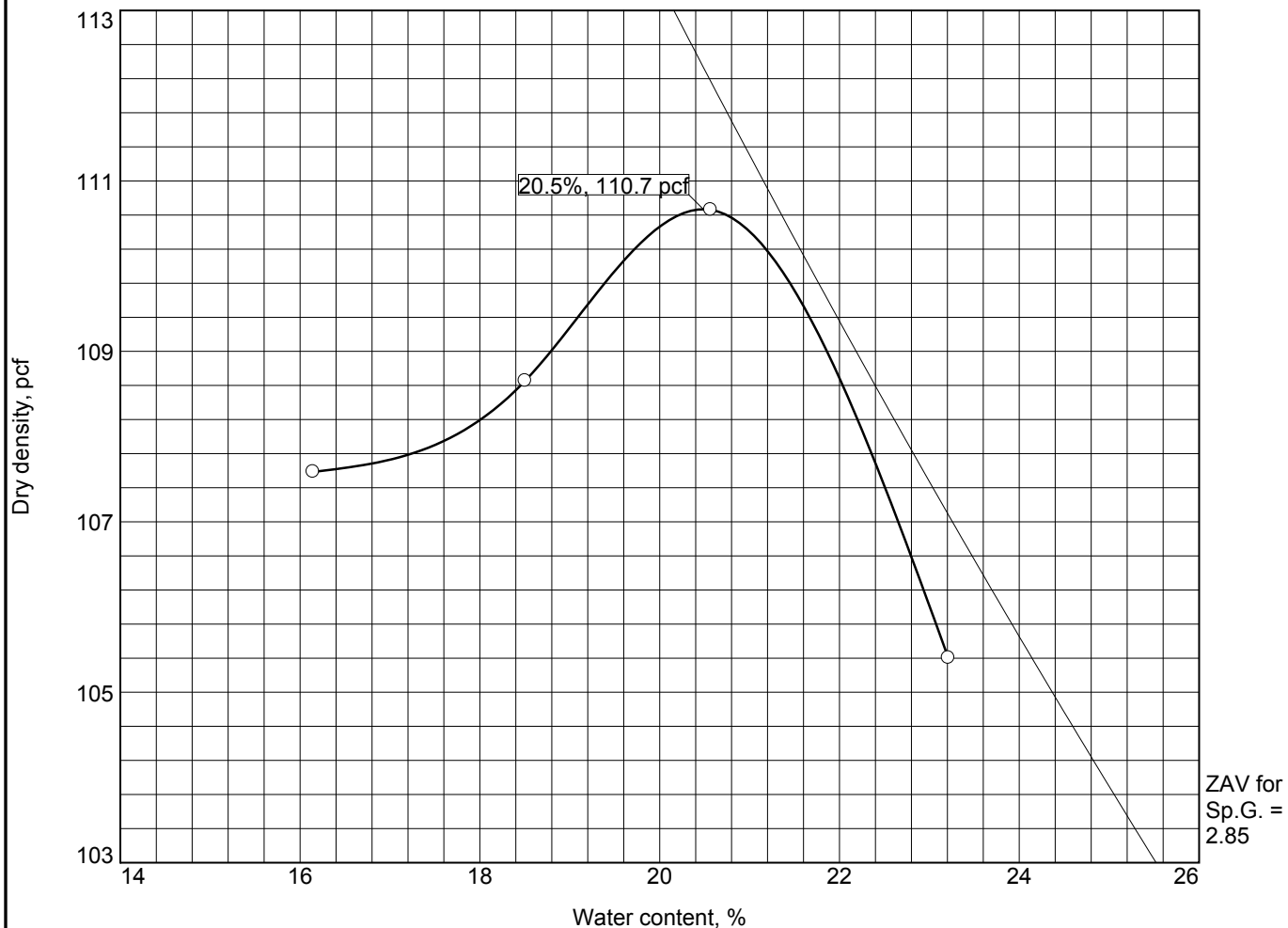
Date: 2-19-18



Client: Hydrometrics  
Project: KMCC Soda Springs Plant


Project No: Site Demolition

Figure



Test specification: ASTM D 698-91 Procedure A Standard

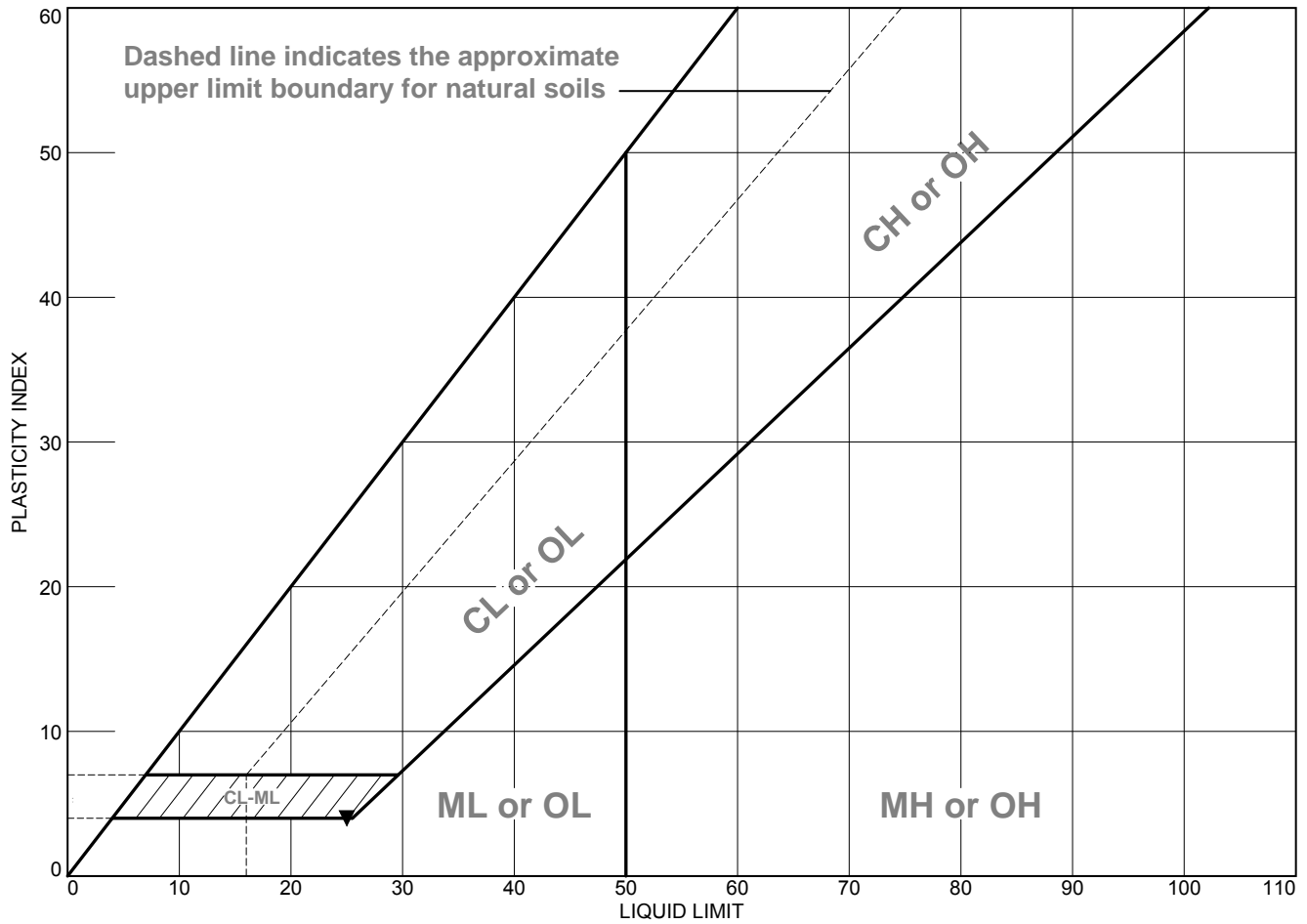
Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
1' and 2.6'	ML	A-4(0)			NV	NP	0	81

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 110.7 pcf  Optimum moisture = 20.5 %	silt with sand
<b>Project No.</b> Site Demolition <b>Client:</b> Hydrometrics <b>Project:</b> KMCC Soda Springs Plant  <b>Date:</b> 2-19-18  <input type="radio"/> <b>Loc.:</b> TP-05 West Calcine Area; Cover soil and Calcine Composite	<b>Remarks:</b>
	

Figure

Figure

# LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	silt with sand	NV	NP	NP	96	81	ML
■		NV	NP	NP			
▲	silty sand with gravel	NV	NP	NP	59	31	SM
◆		NV	NP	NP			
▼		25	21	4			

**Project No.** Site **Client:** Hydrometrics

**Project:** KMCC Soda Springs Plant

**● Loc.:** TP-05 West Calcine Area; Cover soil and Calcine **Sample No.:** 21020-21021  
**■ Loc.:** TP-05 West Calcine Area **Depth:** 2.6' Pure Calcine **Sample No.:** 21021  
**▲ Loc.:** TP-05 West Calcine Area **Depth:** 8.4-8.9' Native **Sample No.:** 21022  
**◆ Loc.:** TP-06; West Calcine Area **Depth:** 3.6' Pure Calcine **Sample No.:** 21024  
**▼ Loc.:** TP-06; West Calcine Area **Depth:** 10.7' Native **Sample No.:** 21025

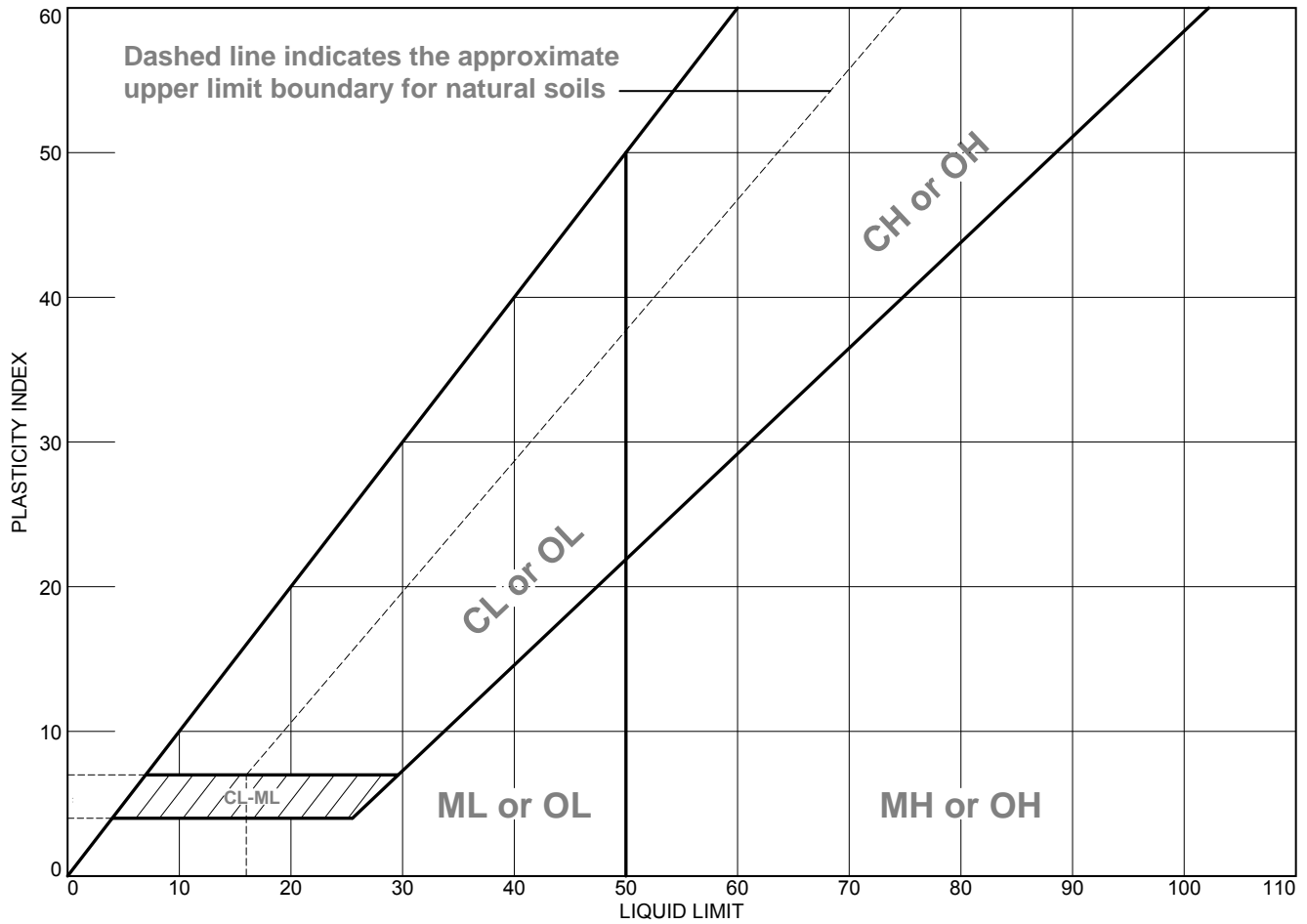


**Remarks:**

**Figure**



# LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●		NV	NP	NP			
■		NV	NP	NP			

**Project No.** Site **Client:** Hydrometrics  
**Project:** KMCC Soda Springs Plant  
**● Loc.:** TP-07; West Calcine Area **Depth:** 3.5-4' Pure Calcine **Sample No.:** 21026  
**■ Loc.:** TP-08; West Calcine Area **Depth:** 1.5' Cover Soil **Sample No.:** 21042

**Remarks:**

Figure



## **HDPE GEOMEMBRANE CHEMICAL COMPATIBILITY TABLES**

Table from "Nonaqueous Phase Liquids Compatibility with Materials Used in Well Construction, Sampling, and Remediation." EPA Groundwater Issue EPA/540/s-95/503. July 1995.

CHEMICAL COMPATIBILITY TABLE																												
For All Non- Metals														For Metals														
R = Resistant A = Excellent - No effect B = Good - Minor effect C = Fair - Moderate effect U = Unsatisfactory X = Conflicting Data - = No Data Available														E < 2 mils Penetration/Year G < 20 mils Penetration/Year S < 50 mils Penetration/Year U > 50 mils Penetration/Year ( 1 mil = .001 inch ) A = Excellent - No effect* B = Good - Minor effect* C = Fair - Moderate effect* * No corrosion rate reported														
	Plastics									Elastopolymers								Metals										
	ABS	Acetal (Delrin)	CPVC	FEP	Nylon 6, 66	HDPE	Polypropylene	PTFE (Teflon)	PVC Type I	PVC Type II	PVDF (Kynar)	EPDM	Kel-F	Neoprene	Nitrile Buna-N	Polyurethane	Silicone	Tygon	Viton-A	Ceramic	Silica	304 Stainless	316 Stainless	Carbon Steel	Hastelloy-C	Aluminum	Brass	Copper
Acetaldehyde	U	A	U	R	U	U	A	A	U	U	X	A	A	C	U	U	A	U	U	-	R	E	E	G	E	G	U	U
Acetamide	-	A	-	R	R	R	A	A	U	-	C	A	A	B	A	U	B	U	B	-	-	G	G	-	-	G	-	-
Acetate Solvent	U	-	U	R	R	R	B	A	U	U	A	A	A	C	U	-	A	U	U	-	-	E	E	G	E	E	S	G
Acetic Acid 10%	X	X	C	R	U	R	B	A	U	-	C	A	A	C	C	-	C	U	R	A	R	E	E	U	E	G	U	G
Acetic Acid, Glacial	U	U	U	R	U	R	A	A	U	U	B	U	A	X	X	U	B	U	U	A	R	E	E	U	E	E	U	U
Acetone	U	A	U	R	R	R	A	A	U	U	U	A	A	U	U	U	B	U	U	A	R	E	E	G	E	E	G	E
Acetonitrile	U	-	-	R	R	-	R	R	-	-	R	R	-	-	-	-	-	-	-	-	-	G	G	G	-	E	G	G
Acetophenone	U	-	-	R	R	U	R	R	U	U	R	R	-	U	U	-	-	-	U	-	-	G	G	G	G	G	G	G
Acetyl Chloride	U	-	U	R	U	U	U	A	U	U	R	U	-	U	U	U	-	-	R	-	R	G	G	G	-	U	U	U
Acetylene	R	-	R	R	R	-	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	E	E	G	G	E	U	U
Acrylonitrile	U	-	X	R	R	R	A	A	X	U	A	X	-	C	U	-	U	-	U	-	-	G	G	G	G	E	G	G
Adipic Acid	R	-	A	R	-	R	B	A	R	R	A	A	A	B	X	-	U	-	X	-	-	G	G	G	E	G	-	G
Aldrin (1 oz/gal)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	E	E	G	-	E	-	-
Allyl Alcohol	U	-	R	R	R	R	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	E	E	G	G	G	G	E
Allyl Chloride	U	-	U	R	-	R	R	R	U	U	R	U	-	U	U	-	-	-	-	-	R	G	E	U	-	U	-	-
Ammonium Acetate	-	-	A	R	A	-	A	A	R	R	R	A	-	A	B	-	-	A	A	-	-	G	G	-	-	G	U	U
Ammonium Oxalate 10%	-	-	-	R	-	-	R	R	R	-	-	R	-	-	-	-	-	-	-	-	-	G	G	U	E	E	-	U
Amyl Acetate	U	B	U	R	R	R	X	A	U	U	A	A	A	U	U	U	U	U	U	A	R	E	E	G	E	E	E	G
Amyl Alcohol	R	A	A	R	A	R	B	A	R	U	A	A	A	A	B	U	U	A	B	A	R	G	G	G	G	G	G	G
Amyl Chloride	U	-	U	R	U	U	U	R	U	U	U	R	-	U	U	-	-	-	R	-	-	G	G	U	E	U	G	G
Aniline	U	A	X	R	X	R	X	A	U	U	A	X	A	U	U	U	U	C	B	A	R	E	E	G	G	G	U	U
Aniline Hydrochloride	U	-	U	R	U	U	X	A	X	U	A	B	-	U	U	-	U	U	A	-	R	U	U	U	U	U	U	G
Antifreeze	B	U	A	-	U	-	U	-	A	-	-	A	-	C	A	-	C	B	A	-	-	-	A	-	-	A	-	-
Aroclor 1248	-	-	-	R	A	U	U	A	-	-	-	B	A	U	X	-	B	-	A	-	-	G	G	G	E	E	E	E
Asphalt	-	B	X	R	A	R	B	A	A	-	A	U	A	U	X	-	U	-	A	-	-	G	G	G	-	E	E	E
Benzaldehyde	X	A	U	R	A	U	X	A	U	U	A	A	A	U	U	U	U	U	U	A	R	G	G	U	G	G	G	G
Benzene	U	A	U	R	A	U	X	A	U	U	A	U	B	U	U	U	U	C	A	A	R	G	G	G	G	E	G	G
Benzo Sulfonic Acid 10%	R	-	R	R	U	R	R	R	R	R	R	U	-	R	U	U	-	-	R	-	R	G	G	U	G	U	G	-
Benzyl Alcohol	U	A	X	R	B	U	A	A	U	U	A	B	A	X	X	U	-	U	A	A	R	E	E	G	G	G	G	E
Benzoic Acid	R	B	A	R	X	B	R	A	R	R	A	U	A	B	U	U	B	A	A	A	R	G	G	U	E	G	G	G
Benzol	U	A	U	R	X	U	U	A	U	U	A	U	A	U	U	U	U	C	A	A	R	G	G	G	G	E	G	G
Benzonitrile	-	-	-	R	R	A	-	A	-	-	-	-	A	-	-	-	A	-	-	-	-	U	U	-	C	-	-	-
Benzyl Chloride	U	A	U	R	R	-	C	R	R	-	R	U	-	U	U	-	U	-	A	-	-	G	G	U	-	U	U	U
Bromobenzene	-	-	-	R	-	-	U	R	-	-	R	U	-	U	U	-	-	-	R	-	-	-	-	-	-	-	-	-
Butadiene	U	A	A	R	R	U	U	A	R	U	A	X	A	B	X	U	U	-	B	-	-	G	G	G	G	G	G	G
Butane	B	A	C	R	R	U	U	A	R	R	A	U	A	A	A	R	U	C	A	-	-	G	G	E	G	G	G	G
Butyl Alcohol	U	A	A	R	B	B	R	A	R	U	A	A	A	A	X	-	B	B	A	-	R	E	E	G	G	E	G	G
n-Butyl Amine	-	X	U	R	R	U	U	A	U	U	X	-	U	U	R	-	B	U	U	-	-	-	G	G	G	G	-	-
Butyl Ether	-	U	U	R	A	-	-	A	R	-	A	U	A	U	B	-	U	A	U	-	-	-	E	E	-	E	-	-
Butyl Phenol	U	-	U	R	-	-	U	R	U	U	R	-	-	U	-	-	-	-	U	-	-	G	E	-	G	G	-	-
Butyl Phthalate	-	-	U	R	R	-	R	R	R	-	R	B	A	D	U	-	A	-	C	-	-	G	G	-	G	U	G	G

	Plastics											Elastopolymers								Metals								
	ABS	Acetal (Delrin)	CPVC	FEP	Nylon 6, 66	HDPE	Polypropylene	PTFE (Teflon)	PVC Type I	PVC Type II	PVDF (Kynar)	EPDM	Kel-F	Neoprene	Nitrile Buna-N	Polyurethane	Silicone	Tygon	Viton-A	Ceramic	Silica	304 Stainless	316 Stainless	Carbon Steel	Hastelloy-C	Aluminum	Brass	Copper
Butylacetate	U	A	X	R	A	R	X	A	U	U	B	B	A	X	U	-	U	U	U	-	R	G	G	G	G	E	G	G
Butyric Acid	U	A	U	R	U	U	R	R	U	U	A	B	A	U	U	-	U	U	B	-	R	G	G	U	E	G	G	G
Carbon Tetrachloride	U	B	U	R	X	U	U	R	U	U	R	U	A	U	U	U	U	B	A	A	R	E	E	G	E	U	G	E
Carbonic Acid	R	B	A	R	R	R	A	A	R	R	A	B	A	X	X	R	A	-	A	A	-	G	G	G	E	E	G	G
Chloroacetic Acid	U	U	U	R	U	U	C	A	R	R	A	U	A	U	U	U	U	A	U	-	-	U	U	U	E	U	U	U
Chlorobenzene	U	X	U	R	R	U	U	B	U	U	A	B	A	U	U	-	U	A	A	A	R	G	G	G	E	G	G	G
Chlorobromomethane	-	-	-	-	C	-	A	A	U	-	-	B	-	U	U	-	U	-	A	A	-	-	-	-	-	-	B	-
Chlordane (1/4 lb/gal)	U	-	-	-	-	-	-	R	-	-	-	U	-	C	B	-	U	-	A	-	-	G	G	G	-	-	-	-
Chloroethane	U	A	U	R	R	R	X	A	U	U	A	X	A	U	U	-	U	-	B	-	-	G	G	G	-	-	-	G
Chloroform	U	A	U	R	R	U	X	A	U	U	A	U	B	U	U	U	U	B	A	A	R	E	E	U	G	G	G	G
Chloronaphthalene	U	-	-	-	-	-	-	-	R	-	-	-	-	U	U	-	-	-	-	-	-	-	G	-	E	U	-	-
Chlorophenol 5% (aq.)	-	R	U	R	U	-	-	R	U	U	R	-	-	-	-	-	-	-	-	-	-	G	G	S	E	-	-	-
Citric Acid	U	B	B	R	R	A	A	A	R	-	A	A	A	A	A	-	A	-	A	A	R	E	E	U	E	E	-	E
Cresol	U	U	U	R	U	U	U	R	X	U	R	U	A	U	U	U	U	U	X	-	R	E	G	G	G	G	-	-
Cresylic Acid 50%	U	U	U	R	U	R	X	R	R	R	R	X	-	U	U	U	U	-	A	-	-	G	G	G	G	G	-	-
Crude Oil	R	R	R	R	R	U	R	U	U	U	U	U	-	U	R	R	-	-	R	-	-	E	E	G	E	E	G	G
Cyclohexane	R	A	U	R	R	R	U	A	X	-	R	U	A	U	B	R	U	U	A	-	-	G	G	G	G	G	G	G
Cyclohexanone	U	A	U	R	R	U	U	A	U	U	R	B	U	U	U	-	U	U	U	A	-	G	G	U	G	G	G	G
DDT 5%	-	-	U	-	-	-	-	-	U	U	-	-	-	-	-	-	-	-	-	-	-	E	E	G	-	E	-	-
Detergents (general)	B	A	A	R	R	R	A	A	R	R	A	A	A	B	A	-	A	A	A	A	-	E	G	G	E	G	G	E
Diacetone Alcohol	-	A	U	R	R	R	R	A	R	-	A	A	B	U	U	-	U	B	U	-	-	G	G	G	E	E	E	E
Dibutyl Phthalate	U	-	U	R	R	U	R	R	U	U	U	R	-	U	U	U	-	-	U	-	-	G	G	G	G	G	G	G
Dichlorobenzene	U	-	U	R	X	U	C	A	U	U	A	U	-	U	U	-	U	-	C	-	-	-	G	-	E	G	-	-
Dichloroethane	U	A	U	R	R	R	X	A	U	U	A	U	A	U	U	-	-	U	C	A	R	G	G	G	G	G	G	-
Dichloroethylene	U	-	-	R	R	-	R	R	U	U	R	U	-	U	U	-	-	-	R	-	-	G	G	-	G	G	-	-
Dichlorofluoromethane	-	-	-	R	-	-	-	R	U	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diesel Fuel	-	A	A	R	R	R	A	A	R	-	A	U	A	B	A	-	U	-	A	-	-	E	E	G	G	E	E	-
Diethanolamine	-	-	-	R	R	-	R	R	U	U	U	-	-	R	-	-	-	-	-	-	-	E	E	E	E	E	-	G
Diethyl Amine	U	B	U	R	R	U	A	X	U	-	X	B	A	A	C	-	B	C	A	-	-	G	G	U	-	G	-	-
Diethyl Ether	U	R	U	R	R	U	R	A	U	U	R	U	C	U	U	-	U	-	U	-	-	G	G	G	G	G	G	G
Diethyl Phthalate	-	-	-	-	-	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diethylene Glycol	B	A	A	R	R	R	A	A	X	-	A	A	-	A	A	-	B	C	A	-	-	E	E	E	G	G	-	G
Dimethyl Aniline	U	U	U	R	R	-	X	A	U	U	A	B	A	U	U	-	U	U	U	-	-	B	B	-	B	A	-	-
Dimethyl Ether	-	-	-	R	-	-	-	R	-	-	-	-	-	U	R	-	-	-	-	-	-	G	G	-	G	-	G	G
Dimethyl Formamide	U	X	U	R	R	R	A	X	U	U	U	X	A	X	U	-	C	U	X	-	-	-	G	U	-	E	-	-
Dimethyl Phthalate	U	-	-	R	R	-	R	R	U	U	R	-	-	U	U	-	-	-	R	-	-	E	E	E	-	E	-	-
Dimethyl Sulfoxide	-	R	U	R	R	R	R	R	U	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dinitrotoluene	-	-	-	-	-	-	-	R	-	-	-	U	-	U	U	-	U	-	X	-	-	G	G	-	-	-	-	-
Diethyl Phthalate	U	-	U	R	R	U	U	R	U	U	R	R	-	U	U	U	-	-	R	-	-	G	G	G	-	E	-	-
Dioxane	U	R	-	R	R	U	R	R	U	-	U	U	-	U	U	-	-	-	U	-	-	G	G	G	G	G	G	G
Diphenyl	-	-	-	R	R	-	U	A	U	-	-	U	-	B	U	R	U	-	A	-	-	G	G	G	G	G	G	G
Diphenyl Oxide	-	U	-	-	-	-	U	A	U	-	B	U	-	U	A	-	C	U	A	-	-	B	A	-	B	B	-	A
Esters (general)	-	-	U	R	R	-	-	R	U	U	R	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-
Ethane	-	A	A	-	U	-	U	A	A	-	A	U	-	B	A	-	U	A	A	-	-	A	A	-	-	-	-	A
Ethanolamine	-	U	U	R	R	-	X	A	U	-	X	B	U	B	B	-	B	-	U	A	-	E	E	G	G	G	-	-
Ethers (general)	U	A	U	-	R	U	U	A	U	U	R	C	B	U	X	-	U	C	X	-	R	E	E	G	G	G	G	G
Ethyl Acetate	U	A	U	R	R	R	A	A	U	U	X	B	A	U	U	U	B	U	U	A	R	G	G	G	G	-	G	G
Ethyl Alcohol	B	A	B	R	R	R	A	A	R	R	R	A	B	A	C	U	B	C	A	A	R	G	G	G	E	E	G	G
Ethyl Benzene	-	R	-	R	-	U	U	R	U	U	R	U	-	U	U	-	-	-	R	-	-	S	G	U	E	G	-	-
Ethyl Benzoate	U	-	U	-	-	U	B	A	U	-	U	-	-	U	U	-	U	U	A	-	-	-	-	-	-	-	-	-
Ethyl Chloride	U	R	U	R	R	U	U	R	U	U	R	R	-	U	R	U	-	-	B	-	R	E	E	G	G	-	-	G
Ethyl Ether	U	A	U	R	R	U	U	A	U	U	R	U	A	U	X	U	U	-	U	-	R	G	G	G	G	G	G	G

	Plastics											Elastopolymers								Metals								
	ABS	Acetal (Delrin)	CPVC	FEP	Nylon 6, 66	HDPE	Polypropylene	PTFE (Teflon)	PVC Type I	PVC Type II	PVDF (Kynar)	EPDM	Kel-F	Neoprene	Nitrile Buna-N	Polyurethane	Silicone	Tygon	Viton-A	Ceramic	Silica	304 Stainless	316 Stainless	Carbon Steel	Hastelloy-C	Aluminum	Brass	Copper
Ethyl Sulfate	-	-	-	-	-	-	-	A	-	-	-	-	A	-	A	-	-	-	A	-	-	U	U	-	-	-	-	B
Ethylene Bromide	U	-	U	R	R	U	U	A	U	U	A	X	B	X	U	-	U	U	A	-	-	E	E	-	E	-	-	-
Ethylene Chloride	U	A	U	R	R	R	X	A	U	U	A	X	A	U	U	-	U	-	B	-	-	G	G	G	-	-	-	G
Ethylene Chlorohydrin	U	U	U	R	U	U	X	A	U	U	A	B	-	X	U	U	C	U	A	-	-	G	G	G	G	G	G	G
Ethylene Diamine	U	X	U	R	U	-	R	A	U	U	B	A	U	X	A	-	A	-	B	-	-	G	G	G	U	G	U	U
Ethylene Dibromide	-	-	-	R	-	-	R	R	-	-	R	-	-	-	-	-	-	-	-	-	-	-	G	-	G	-	G	-
Ethylene Glycol	A	B	A	R	R	R	A	A	R	R	A	A	A	A	A	R	A	B	R	U	A	-	G	G	G	E	E	G
Ethylene Oxide	U	U	X	R	R	R	U	A	U	U	A	X	C	U	U	U	U	-	U	-	R	G	G	G	E	E	U	-
Formaldehyde 100%	B	A	A	-	U	-	C	A	A	-	A	A	A	C	C	-	B	B	U	-	-	C	A	-	A	A	-	A
Formaldehyde 37%	A	A	A	R	R	R	A	A	R	R	A	A	A	B	X	U	-	-	R	-	R	E	E	U	G	G	E	G
Formic Acid 5%	-	U	R	R	U	R	R	R	R	-	R	R	-	R	U	-	-	-	R	-	-	G	E	-	E	U	S	E
Fuel oils	U	A	-	R	R	R	A	B	R	R	B	U	A	B	X	R	U	A	A	-	-	G	G	G	G	G	G	G
Gasoline (high-aromatic)	U	B	A	-	-	-	A	B	A	-	A	U	A	A	A	-	U	A	A	A	-	A	A	-	A	U	-	-
Gasoline (leaded)	U	A	U	R	R	U	X	A	R	-	A	U	A	B	A	R	U	C	A	A	-	A	G	G	G	E	G	G
Gasoline (unleaded)	U	A	X	R	R	U	X	A	R	-	A	U	A	B	A	R	U	C	A	-	-	G	G	G	E	G	G	G
Glycolic Acid	B	A	A	R	-	R	A	A	R	R	B	A	B	A	A	-	A	A	A	-	-	G	G	U	G	G	-	-
Heptane	X	A	A	R	R	R	C	A	R	R	A	U	A	B	A	U	U	B	A	-	-	G	G	G	E	G	G	G
Hexachloroethane	-	-	-	-	-	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	G	G	-	G	G	S	G
Hexamine	-	-	-	R	-	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	E	E	-	E	E	G	-
Hexane	U	A	B	R	R	U	B	A	R	R	A	U	A	B	A	R	U	U	A	-	-	E	E	G	E	G	G	-
Hexyl Alcohol	-	A	-	-	A	-	-	A	A	-	-	C	-	A	A	-	B	A	C	-	-	A	A	-	A	A	-	-
Hydraulic Oil (petro.)	-	B	-	-	A	-	U	A	A	-	A	U	-	A	A	-	B	A	A	-	-	A	A	-	A	A	A	A
Hydraulic Oil (synthetic)	-	-	-	-	A	-	U	A	A	-	A	A	-	A	U	-	B	A	A	-	-	A	A	-	A	A	A	A
Hydrazine	-	B	U	-	-	U	C	C	-	-	A	A	-	B	B	-	B	-	A	-	-	A	A	-	-	-	-	A
Hydrogen Peroxide (dilute)	R	R	U	R	R	R	R	R	R	-	R	R	-	U	R	-	-	-	R	-	-	G	G	U	E	E	U	U
Hydroquinone	X	A	A	R	U	-	A	A	R	R	R	U	-	A	X	-	-	-	B	-	-	G	G	G	G	G	G	-
Hydroxyacetic Acid 70%	-	A	A	-	-	-	-	A	U	-	A	A	-	A	A	-	-	-	A	-	-	-	-	-	-	-	-	-
Iodoform	-	-	-	R	-	-	R	C	-	-	C	A	-	A	U	-	-	C	R	-	R	E	E	U	U	G	-	G
Isobutyl Alcohol	B	A	-	-	A	-	A	A	A	-	-	A	-	A	B	-	A	A	A	-	-	-	-	-	-	-	-	-
Isooctane	-	-	-	-	A	B	A	A	A	-	A	U	A	B	A	-	U	A	A	-	-	A	A	-	-	A	A	-
Isopropyl Acetate	U	U	U	R	R	R	B	A	U	U	X	B	-	U	U	-	U	-	U	-	-	E	G	E	G	G	-	-
Isopropyl Alcohol	R	A	C	R	U	R	A	A	R	R	R	A	-	B	B	U	A	A	A	A	-	A	G	G	G	G	G	G
Isopropyl Ether	-	U	R	R	R	-	X	A	R	R	X	U	A	U	B	R	U	A	U	-	-	E	G	-	-	-	G	G
Isotane	-	-	-	-	U	-	U	-	A	-	A	-	-	U	A	-	-	-	-	A	-	-	-	-	-	U	-	-
Jet Fuel JP-4, JP-5	-	A	R	R	R	-	A	A	R	R	A	U	A	U	A	U	U	A	A	-	-	G	G	G	E	G	E	-
Kerosene	X	A	R	R	R	R	R	A	R	R	A	U	A	A	A	U	U	U	A	A	-	G	G	G	G	G	G	G
Lacquer thinners	A	U	-	-	A	-	U	A	U	-	-	U	-	U	U	-	U	U	U	-	-	-	G	-	-	G	-	-
Lacquers	A	U	-	-	A	-	U	A	U	-	U	U	-	U	U	-	U	A	U	-	-	E	E	-	-	-	-	-
Lactic Acid	U	B	A	R	R	-	B	A	R	R	B	A	A	A	X	-	A	A	A	A	-	A	G	G	U	G	G	G
Lead Acetate	B	B	A	R	R	R	A	A	R	R	A	A	A	A	B	-	A	B	U	A	-	G	G	U	G	U	U	G
Linoleic Acid	A	B	A	R	U	U	B	A	R	R	A	U	-	U	B	-	B	A	B	-	-	G	G	U	G	G	U	U
Maleic Acid	R	A	A	R	X	R	R	A	R	R	A	X	-	U	U	-	-	C	A	-	R	G	G	U	G	-	G	-
Malic Acid	R	A	R	R	X	R	A	A	R	R	A	U	-	X	A	-	B	A	A	-	-	E	E	U	G	G	-	U
Melamine	-	A	A	-	A	-	A	A	U	-	-	A	-	U	C	-	C	U	A	-	-	-	U	-	-	-	-	-
Methane	-	A	-	R	R	-	A	A	R	R	A	X	-	B	A	-	U	-	A	-	-	E	E	G	E	E	E	G
Methyl Acetate	U	X	U	R	R	R	X	A	U	U	B	X	A	X	U	-	U	A	U	-	-	G	G	S	E	G	-	-
Methyl Acetone	-	U	-	-	A	-	-	A	U	-	U	A	-	U	U	-	-	A	U	-	-	A	A	-	-	A	A	-
Methyl Acylate	-	B	-	-	-	-	U	-	-	-	B	B	-	B	U	-	U	-	U	-	-	A	-	-	-	-	-	-
Methyl Alcohol	U	A	A	R	R	R	A	A	R	R	A	A	A	A	A	U	A	A	U	A	R	G	G	G	E	G	G	G
Methyl Alcohol 10%	U	A	A	-	B	B	A	A	-	-	A	A	A	A	A	-	A	A	A	A	-	-	-	-	-	-	-	-
Methyl Amide	U	U	-	-	-	-	A	A	U	-	C	A	A	-	B	-	-	U	U	-	-	A	A	-	-	A	U*	-
Methyl Bromide	U	U	U	R	U	R	X	A	U	U	A	U	-	U	B	-	-	-	A	-	-	G	G	G	-	U	-	-
Methyl Butyl Ketone	-	U	-	-	U	U	U	-	-	-	U	A	-	U	U	-	U	-	U	-	-	A	A	-	-	-	-	-

	Plastics										Elastopolymers									Metals								
	ABS	Acetal (Delrin)	CPVC	FEP	Nylon 6, 66	HDPE	Polypropylene	PTFE (Teflon)	PVC Type I	PVC Type II	PVDF (Kynar)	EPDM	Kel-F	Neoprene	Nitrile Buna-N	Polyurethane	Silicone	Tygon	Viton-A	Ceramic	Silica	304 Stainless	316 Stainless	Carbon Steel	Hastelloy-C	Aluminum	Brass	Copper
Methyl Chloride	U	B	U	R	R	U	U	A	U	U	A	U	A	U	U	U	U	U	A	-	-	E	E	U	G	U	E	G
Methyl Chloroform	U	-	U	R	-	-	U	R	U	U	R	U	-	U	U	-	-	-	R	-	-	-	-	-	-	-	-	-
Methyl Dichloride	-	U	-	-	C	-	U	-	-	-	U	U	-	-	U	-	-	-	A	-	-	-	-	-	-	-	-	-
Methyl Ethyl Ketone	U	U	U	R	R	U	B	A	U	U	U	A	A	U	U	U	U	U	U	A	-	G	G	G	G	G	G	G
Methyl Isopropyl Ketone	-	-	-	-	A	-	-	A	U	-	-	C	-	U	U	-	C	-	U	-	-	A	A	-	-	A	-	A
Methyl Methacrylate	-	U	R	R	-	-	X	R	R	U	B	U	-	U	U	-	C	-	U	-	-	G	G	U	-	G	-	-
Methyl Pentanone	U	-	U	R	R	R	R	A	U	U	X	B	A	U	U	-	U	-	U	-	-	G	G	G	G	G	G	G
Methylene Chloride	U	B	U	R	U	U	B	A	U	U	B	X	A	U	U	U	-	U	B	-	R	G	G	G	E	E	G	G
Monochloroacetic acid	-	U	-	-	U	U	-	A	-	-	B	C	B	A	U	-	-	-	C	-	-	A	A	-	A	U*	B	
U*																												
Monoethanolamine	-	U	-	R	R	-	B	A	U	U	U	B	-	X	B	-	B	-	X	-	-	E	E	G	G	G	G	G
Motor Oil	C	B	A	R	R	U	U	A	R	R	B	U	A	B	A	-	-	A	R	A	-	G	G	G	-	-	G	G
Napthalene	U	X	U	R	R	U	R	A	U	U	A	U	A	U	U	R	U	C	A	A	-	E	E	G	G	G	G	G
Nitrobenzene	U	X	U	R	R	U	B	A	U	U	A	U	A	U	U	U	U	U	B	-	R	G	G	G	G	E	G	G
Nitromethane	U	A	U	R	U	-	R	A	R	R	A	B	A	U	U	-	U	B	U	-	-	G	G	G	-	G	-	-
Nitrophenol	-	-	-	-	-	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	G	G	-	-	G	-	G
Octane	-	-	-	R	-	R	R	R	U	U	R	U	-	R	R	-	-	-	R	-	-	-	G	G	-	G	G	G
Octyl Alcohol	A	A	B	-	A	-	-	-	-	-	-	B	-	B	B	-	B	-	B	-	-	A	A	-	C	A	-	A
Oleic Acid	X	A	A	R	R	U	B	A	R	R	A	B	B	X	B	R	U	C	B	A	-	E	E	G	G	G	S	G
Oxalic Acid 5%	R	U	R	R	U	R	R	R	R	R	R	R	-	R	U	-	-	-	R	-	-	U	G	U	G	G	S	G
Palmitic Acid 10%	A	A	A	R	R	R	B	A	R	R	A	B	-	U	A	R	U	B	A	-	-	-	G	-	-	G	G	G
Pentachlorophenol	-	-	-	-	-	-	-	R	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	E	-	-	-	-
Pentane	-	B	-	-	A	-	U	A	A	-	A	U	-	B	A	-	U	A	A	-	-	C	C	-	A	B	-	-
Petroleum	B	B	A	R	-	U	B	A	R	-	A	U	-	B	A	-	U	-	A	-	-	G	G	-	-	G	G	G
Phenol 10%	U	X	A	R	U	R	B	A	U	U	A	B	B	U	U	U	U	C	A	A	-	G	G	G	G	E	G	G
Phthalic Acid	B	C	X	R	R	-	A	A	U	U	A	A	-	A	U	-	B	-	A	-	-	G	E	S	G	G	G	G
Phthalic Anhydride	B	C	U	R	-	-	U	A	U	-	A	A	-	A	U	-	-	B	A	-	-	E	E	G	E	E	G	-
Picric Acid	X	A	U	R	U	U	A	A	U	U	A	A	-	A	X	-	B	-	A	-	R	G	G	U	G	E	U	U
Propyl Alcohol	X	A	A	R	U	R	A	A	R	R	A	A	A	A	A	-	A	A	A	A	-	E	E	G	E	G	G	G
Propylene	B	-	-	-	-	-	-	A	B	-	-	U	-	U	U	-	U	B	A	-	-	B	A	-	-	A	-	A
Propylene Glycol	B	B	X	R	R	R	A	A	U	U	A	A	-	C	A	-	A	-	A	A	-	G	G	G	G	G	G	G
Propylene Oxide	-	-	-	R	-	R	R	R	U	U	U	R	-	U	U	-	-	-	U	-	-	E	E	-	-	-	-	-
Pyridine	-	B	U	R	R	R	A	A	U	U	U	X	A	U	U	-	U	U	U	A	-	G	G	G	E	G	G	G
Sodium Acetate	B	B	A	R	R	R	A	A	R	R	A	A	A	B	B	-	U	-	U	A	-	G	G	U	G	E	G	G
Sodium Benzoate	A	-	A	R	R	R	A	A	R	R	A	A	-	A	B	-	-	B	A	-	-	-	-	-	G	G	-	E
Sodium Hypochlorite 20%	R	U	R	R	U	R	R	R	R	R	R	R	A	U	U	-	B	C	A	-	U	U	U	U	G	G	-	S
Stearic Acid	U	A	B	R	R	R	A	A	R	R	A	X	-	B	B	R	B	B	A	-	R	G	E	S	E	G	S	G
Styrene	-	A	U	-	A	U	-	A	U	-	-	U	-	U	U	-	U	-	B	-	-	A	A	-	U*	A	A	B
Tartaric Acid	-	B	A	-	B	-	A	A	A	-	B	B	A	A	A	-	A	B	A	A	-	C	C	-	B	B	U*	A
Tetrachloroacetic Acid	R	-	R	R	R	R	R	R	R	R	R	U	-	R	R	R	-	-	R	-	-	E	E	-	G	G	S	U
Tetrachloroethane	-	A	X	R	R	-	C	A	U	U	A	U	A	U	U	-	U	-	A	-	R	E	E	E	E	G	-	S
Tetrachloroethylene	U	A	U	R	R	U	U	A	U	U	R	U	A	U	U	U	U	-	A	-	-	E	E	G	G	G	G	G
Tetrachlorophenol	-	-	-	-	-	-	R	R	-	-	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetraethyl Lead	U	-	R	R	-	U	R	R	R	R	R	U	-	-	U	-	-	-	R	-	-	G	G	G	-	G	G	-
Tetrahydrofuran	U	A	U	R	R	U	C	A	U	U	B	U	A	U	U	-	U	-	X	A	-	E	G	E	E	U	-	-
Toluene	U	X	U	R	R	U	C	A	U	U	A	U	B	U	X	U	U	U	C	A	-	E	E	E	E	E	E	E
Toxaphene-Xylene 10-90%	-	-	U	R	-	-	R	R	U	-	-	-	-	-	-	-	-	-	-	-	-	G	G	S	-	S	-	-
Trichloroacetic Acid	-	-	R	R	U	R	A	A	R	-	B	B	A	U	R	-	U	C	C	A	-	U	U	U	G	U	G	G
Trichlorobenzene	-	-	-	-	-	-	-	R	U	-	-	-	-	U	U	U	-	-	R	-	-	-	-	E	-	-	-	-
Trichloroethane	-	A	-	-	-	-	C	A	C	-	A	U	A	U	U	-	U	-	A	-	-	-	-	-	-	-	-	-
Trichloroethylene	U	U	U	R	R	U	C	A	U	U	B	U	A	U	U	U	U	-	X	A	-	G	G	G	E	E	G	G
Trichlorofluoromethane	-	-	-	-	-	-	-	-	U	-	-	-	-	U	U	-	-	-	-	-	-	-	G	-	-	G	-	-
Trichloropropane	U	A	-	-	-	-	-	A	-	-	-	-	A	A	U	-	-	U	A	-	-	A	A	-	A	U*	-	A

	Plastics											Elastopolymers								Metals								
	ABS	Acetal (Delrin)	CPVC	FEP	Nylon 6, 66	HDPE	Polypropylene	PTFE (Teflon)	PVC Type I	PVC Type II	PVDF (Kynar)	EPDM	Kel-F	Neoprene	Nitrile Buna-N	Polyurethane	Silicone	Tygon	Viton-A	Ceramic	Silica	304 Stainless	316 Stainless	Carbon Steel	Hastelloy-C	Aluminum	Brass	Copper
Triethanolamine	R	U	R	R	R	U	R	R	U	U	R	R	-	R	U	U	-	-	R	-	-	G	G	G	G	G	U	E
Triethylamine	U	U	A	R	R	-	U	A	R	R	A	A	A	A	C	-	-	A	X	B	-	G	G	-	-	-	-	
Trimethylpropane	U	-	R	R	-	-	U	R	R	R	R	-	-	-	R	R	-	-	-	-	-	-	-	-	-	-	-	
Turpentine	U	A	A	R	R	U	X	A	X	U	A	U	A	U	R	U	U	B	A	A	-	E	E	G	G	G	S	G
Vinyl Acetate	U	-	U	R	-	U	B	A	U	U	A	B	-	X	X	-	U	U	A	B	-	E	E	G	E	E	G	-
Vinyl Chloride	U	-	U	-	A	-	-	A	U	-	B	C	-	U	U	-	-	U	A	A	-	B	A	-	A	B	-	B
White liquor (Pulp mill)	X	U	R	R	R	-	R	R	R	R	R	R	-	R	R	-	-	-	R	-	-	G	G	S	G	G	-	-
White Water (Paper mill)	R	B	-	-	R	-	R	-	R	-	-	-	-	A	-	-	-	-	A	-	-	A	A	-	-	-	-	-
Xylene	U	A	U	R	R	U	B	A	U	U	A	U	A	U	U	U	U	U	X	A	-	G	G	G	E	G	G	G

This table should only be used as a guide since it is difficult to duplicate operating conditions. To fully guarantee the suitability of a particular material, chemical resistance tests should be conducted under actual operating conditions.

No data was found on the following environmentally important chemicals:

Acenaphthene <sup>(1)</sup>  
 Acenaphthalene <sup>(1)</sup>  
 Acrolein  
 Anthracene <sup>(1)</sup>  
 Benzidine  
 Benzo(a)anthracene <sup>(1)</sup>  
 Benzo(b)fluoranthene <sup>(1)</sup>  
 Benzo(g,h,i)perylene <sup>(1)</sup>  
 Benzo(a)pyrene <sup>(1)</sup>  
 Bromophenylphenylether  
 Butylbenzylphthalate  
 Chlorodibromomethane  
 Chloroethoxymethane  
 Chloroethylether  
 Chloroethylvinylether  
 Chloroisopropylether

Chloromethylether  
 Chlorophenylphenylether  
 Chrysene <sup>(1)</sup>  
 DDD <sup>(2)</sup>  
 DDE <sup>(2)</sup>  
 Dichlorobenzidine  
 Dichlorobromomethane  
 Dichlorophenol  
 Dichlorophenoxyacetic acid  
 Dichloropropane  
 Dichloropropylene  
 Dieldrin <sup>(2)</sup>  
 Dinitrophenol  
 Diphenylhydrazine  
 Endosulfan  
 Endrin <sup>(2)</sup>

Fluoranthene <sup>(1)</sup>  
 Fluorene <sup>(1)</sup>  
 Heptachlor <sup>(2)</sup>  
 Hexachlorobenzene  
 Hexachlorobutadiene  
 Hexachlorocyclohexane  
 Indeno(1,2,3-c,d)pyrene <sup>(1)</sup>  
 Isophorone  
 2-Methylnapthalene  
 Parachlorometa cresol  
 Phenanthrene <sup>(1)</sup>  
 Phenyleneepyrene  
 Pyrene <sup>(1)</sup>  
 Trichlorophenol  
 Trichlorophenoxyacetic acid

<sup>(1)</sup> Component of cresotoe and coal tar. At room temperature and below, these compounds are solid in pure form.

<sup>(2)</sup> Pesticides

## CHEMICAL COMPATIBILITY OF POLY-FLEX® LINERS

Chemical compatibility or resistance, as applied to geomembranes, is a relative term. Actual compatibility would mean that one material dissolves in the other, such as alcohol in water or grease in gasoline. An example of incompatibility would be oil and water. In liners it is undesirable to have the chemicals dissolve in the liner, hence the term compatibility is the reverse of what is normally meant in the chemical industry. In the strictest sense and from a laboratory perspective, chemical compatibility, as the term applies to this industry, would imply that the chemical has no effect on the liner. From an engineering perspective, chemical compatibility means that a liner survives the exposure to a given chemical even though the chemical could have some effect on the performance of the liner, but not enough to cause failure. One must understand and define chemical compatibility for a specific project.

Generally polyethylene is affected by chemicals in one of three ways:

1. No effect—This means that the chemical in question and the polyethylene do not interact. The polyethylene does not gain (lose) weight or swell, and the physical properties are not significantly altered.
2. Oxidizes (cross linking)—Chemicals classed as oxidizing agents cause the polyethylene molecules to cross link and cause irreversible changes to the physical properties of the liner, i.e., they make the liner brittle.
3. Plasticizes—Chemicals in this classification are soluble in the polyethylene structure. They do not change the structure of the polyethylene itself but act as a plasticizer. In doing so, the liner experiences weight gain of 3-15%, may swell by up to 10%, and has measurable changes in physical properties (e.g. the tensile strength at yield may decrease by up to 20%). Even under these conditions the liner maintains its integrity and is not breached by liquids, provided the liner has not been subjected to any stress. These effects are reversible once the chemicals are removed and the liner has time to dry.

Aside from the effect that chemicals have on a liner is the issue of vapor permeation through the liner. Vapor permeation is molecular diffusion of chemicals through the liner. Vapor transmission for a given chemical is dependent primarily on liner type, contact time, chemical solubility, temperature, thickness, and concentration gradient, but not on hydraulic head or pressure. Transmission through the liner can occur in as little as 1-2 days. Normally, a small amount of chemical is transmitted.

As stated above, chemical compatibility is a relative term. For example, the use of HDPE as a primary containment of chlorinated hydrocarbons at a concentration of 100% may not be recommended, but it may be acceptable at 0.1% concentration for a limited time period or may be acceptable for secondary containment. Factors that go into assessment of chemical compatibility are type of chemical(s), concentration, temperature, and the type of application. No hard and fast rules are available to make decisions on chemical compatibility. Even the EPA 9090 test is just a method to generate data so that an opinion on chemical compatibility can be more reliably reached.

A simplified table on chemical resistance is provided to act as a screening process for chemical containment applications.



CHEMICAL CLASS	CHEMICAL EFFECT	PRIMARY CONTAINMENT (LONG TERM CONTACT)		SECONDARY CONTAINMENT (SHORT TERM CONTACT)	
		HDPE	LLDPE	HDPE	LLDPE
CARBOXYLIC ACID - Unsubstituted (e.g. Acetic acid) - Substituted (e.g. Lactic acid) - Aromatic (e.g. Benzoic Acid)	1	B A A	C B B	A A A	C A A
ALDEHYDES - Aliphatic (e.g. Acetaldehyde) - Hetrocyclic (e.g. Furfural)	3	B C	C C	B B	C C
AMINE - Primary (e.g. Ethylamine) - Secondary (e.g. Diethylamine) - Aromatic (e.g. Aniline)	3	B C B	C C C	B B B	C C C
CYANIDES (e.g. Sodium Cyanide)	1	A	A	A	A
ESTER (e.g. Ethyl acetate)	3	B	C	B	C
ETHER (e.g. Ethyl ether)		C	C	B	C
HYDROCARBONS - Aliphatic (e.g. Hexane) - Aromatic (e.g. Benzene) - Mixed (e.g. Crude oil)	3	C C C	C C C	B B B	C C C
HALOGENATED HYDROCARBONS - Aliphatic (e.g. Dichloroethane) +A4 - Aromatic (e.g. Chlorobenzene)	3	C C	C C	B B	C C
ALCOHOLS - Aliphatic (e.g. Ethyl alcohol) - Aromatic (e.g. Phenol)	1	A A	A C	A A	A B
INORGANIC ACID - Non-oxidizers (e.g. Hydrochloric acid) - Oxidizers (e.g. Nitric Acid)	1 2	A C	A C	A B	A C
INORGANIC BASES (e.g. Sodium hydroxide)	1	A	A	A	A
SALTS (e.g. Calcium chloride)	1	A	A	A	A
METALS (e.g. Cadmium)	1	A	A	A	A
KETONES (e.g. Methyl ethyl ketone)	3	C	C	B	C
OXIDIZERS (e.g. Hydrogen peroxide)	2	C	C	C	C

Chemical Effect (see discussion on Chemical Resistance)

1. No Effect—Most chemicals of this class have no or minor effect.
2. Oxidizer—Chemicals of this class will cause irreversible degradation.
3. Plasticizer—Chemicals of this class will cause a reversible change in physical properties.

Chart Rating

- A. Most chemicals of this class have little or no effect on the liner.  
Recommended regardless of concentration or temperature (below 150° F).
- B. Chemicals of this class will affect the liner to various degrees.  
Recommendations are based on the specific chemical, concentration, and temperature.  
Consult the design engineer.
- C. Chemicals of this class at high concentrations will have a significant effect on the physical properties of the liner.  
Generally not recommended but may be acceptable at low concentrations and with special design considerations.  
Consult the design engineer.

The data in this table are provided for informational purposes only and are not intended as a warranty or guarantee. Poly-America, L.P. assumes no responsibility in connection with the use of these data. Consult with the design engineer for specific chemical resistance information and liner selection.

## **LINER SYTEM CALCULATIONS**

## LINER-DESIGN

Calculations for the FML include:

- Stress from self weight
- Stress during waste placement
- Survivability
- Settlement strain

Assumptions for the FML include:

- FML specific gravity = 0.94
- FML thickness = 60 mil
- Friction angle between FML and soil = 32° (peak), 17° (residual)
- Friction angle between FML and GCL/geocomposite = 32° (peak), 28° (residual)
- Friction angle between soil and geocomposite = 31° (peak), 30° (residual)
- Average waste density = 125 pcf
- Assumed internal friction angle of waste = 30°
- Average soil density = 120 pcf
- Assumed internal friction angle of soil = 32°

Calculations are performed based on guidance found in the documents referenced in the calculations

### TEXTURED FLEXIBLE MEMBRANE LINER DESIGN

TABLE OF DESIGN PARAMETERS

FML Specific Gravity	= $G_s$ =	0.94	
FML Friction Angles			
CL/FML	= $\delta_1$ =	28 °	From manufacturer
FML/GCL or Geotextile	= $\delta_2$ =	17 °	From manufacturer, empirical data
FML Thickness	= $t$ =	60 mil	
FML Yield Stress	= $\sigma$ =	126 lb/in	Specified Minimum
		126 lb/in /	0.06 in x 0.95 = 1995 psi
		50000 psf to	400000 psf = 287280 psf
Cell Slope Angle	= $\beta$ =	18.43 °	
Depth of Cell	= $D$ =	16 ft	Varies
Design Lift Thickness	= $D_L$ =	2 ft	
Cell Side Slope	= $S$ =	3 : 1	
Density Waste	= $\gamma$ =	125 pcf	
Waste Internal Friction	= $\phi$ =	30 °	

# LINER-DESIGN

Check FML Stress,  $\sigma$ , Before Waste Placement From FML Weight On Slopes.  
Steepest side slopes are in the bottom cell.

Figure 3-6<sup>2</sup>

$$\sigma = T / A$$

$$T = W \times \sin(\beta) - F$$

$$W = \text{Liner weight}$$

$$= [G_s \times \delta_w \times t][1 \times D / \sin(\beta)]$$

$$= [0.94 \times 62.4 \text{ pcf} \times 60 / 1000 / 12] \times [1 \text{ ft} \times 16 \text{ ft} / \sin(18.43^\circ)]$$

$$= 14.84 \text{ lb/ft}$$

$$F = \text{Friction Force between liner and slope}$$

$$\text{Minimum friction found at FML - GCL interface}$$

$$= W \times \cos(\beta) \times \tan(\delta_2)$$

$$= 14.84 \text{ lb} \times \cos(18.43^\circ) \times \tan(17^\circ)$$

$$= 4.31 \text{ lb/ft}$$

$$T = 14.84 \text{ lb} \times \sin(18.43^\circ) - 4.31 \text{ lb}$$

$$= 4.69 - 4.31$$

$$= 0.387 \text{ lb/ft}$$

$$A = 1' \times t$$

$$= 1 \text{ ft} \times 60 / 1000 / 12$$

$$= 0.005 \text{ sf}$$

$$\sigma = 0.3873 \text{ lb/ft} / 0.005 \text{ sf}$$

$$= 77.467 \text{ psf/ft}$$

$$FS = 287280 \text{ psf} / 77.467 \text{ psf}$$

$$= 3708.415735 \geq 10 \text{ OK Table 5.17}^1$$

Check Tension Stress,  $\sigma$ , Carried By Primary Geomembrane During Filling

Section 5.6.8<sup>1</sup>

$$\sigma = (F_{\text{Above}} - F_{\text{Below}}) / t$$

$$F_{\text{Above}} = W \times \cos(\beta) \times \tan(\delta_1)$$

$$W = W_w - T_w = \text{Weight of waste - Internal Friction Force on Edge of Waste}$$

$$W_w = 0.5 \times D_L^2 \times S \times \gamma$$

$$= 0.5 \times (2 \text{ ft})^2 \times 3 \times 125 \text{ pcf}$$

$$= 750 \text{ lb/ft}$$

$$T_w = \sigma_H \times \tan(\phi) \times D_L$$

$$\sigma_H = K_O \times \sigma_V$$

$$K_O = 1 - \sin \phi$$

$$= 1 - \sin(30^\circ)$$

$$= 0.5$$

$$\sigma_V = \gamma \times D_L / 2$$

$$= 125 \text{ pcf} \times 2 \text{ ft} / 2$$

$$= 125 \text{ psf}$$

$$\sigma_H = 0.5 \times 125 \text{ psf}$$

$$= 62.5 \text{ psf}$$

$$T_w = 62.5 \text{ psf} \times \tan(30^\circ) \times 2 \text{ ft}$$

$$= 360.84 \text{ lb/ft}$$

$$W = 750 \text{ lb/ft} - 360.84 \text{ lb/ft}$$

$$= 389.16 \text{ lb/ft}$$

$$W \times \cos(\beta) = 389.16 \text{ lb} \times \cos(18.43^\circ)$$

$$= 369.2 \text{ lb/ft}$$

$$= 369.196503 \text{ lb/ft} \times \tan(28^\circ)$$

$$= 196.3052628 \text{ lb/ft}$$

## LINER-DESIGN

$$\begin{aligned}
 F_{\text{Below}} &= W \times \cos(\beta) \times \tan(\delta_2) \\
 &= 369.196503 \text{ lb} \times \tan(17^\circ) \\
 &= 112.8746984 \text{ lb/ft} \\
 \sigma &= (196.31 \text{ lb/ft} - 112.87 \text{ lb/ft}) / (60 / 1000 \text{ ft} - 12 / 1000 \text{ ft}) \\
 &= 83.431 \text{ lb/ft} / 0.005 \text{ ft} \\
 &= 16686 \text{ psf}
 \end{aligned}$$

$$\begin{aligned}
 \text{FS} &= \sigma / \sigma_{\text{actual}} \\
 &= 287280 \text{ psf} / 16686 \text{ psf} \\
 &= 17.21671202 \geq 0.5 \quad \text{OK} \quad \text{Table 5.17}^1
 \end{aligned}$$

Check Minimum Thickness for General Membrane Installation Survivability

Table 5.11<sup>3</sup>

$$\begin{aligned}
 t_{\text{MIN}} &= 35 \text{ mil for High Survivability, typical of landfill liners and covers.} \\
 &60 \text{ mil} \geq 35 \text{ mil} \quad \text{OK}
 \end{aligned}$$

Check Strain Due to Subsidence

Settlement of Bottom of Landfill Due to Waste Fill

$$\rho = 6 \text{ inches (See GCL settlement calcs)}$$

$$\begin{aligned}
 \text{Installed Slope Length} &= 50.60 \text{ ft} \quad (\text{See GCL settlement calcs}) \\
 \text{Settled Slope Length} &= 50.76 \text{ ft}
 \end{aligned}$$

$$\begin{aligned}
 \text{Strain, } \varepsilon &= (50.8 - 50.6) \text{ ft} / 50.6 \text{ ft} \\
 \varepsilon &= 0.16 \text{ ft} / 50.6 \text{ ft} \\
 \varepsilon &= 0.00317 \text{ ft/ft} = 0.317 \%
 \end{aligned}$$

$$\begin{aligned}
 \text{FML Yield Elongation} &= 13 \% \quad \text{Minimum Specified} \\
 \varepsilon_{\text{yield}} = \ln(1+e) &= 0.122 \text{ ft/ft}
 \end{aligned}$$

$$\begin{aligned}
 \text{FS} &= \varepsilon_{\text{yield}} / \varepsilon \\
 &= 38.57 \geq 10 \quad \text{OK}
 \end{aligned}$$

<sup>1</sup> Koerner, Robert M., *Designing With Geosynthetics, Second Edition*, Prentice Hall, 1990.

<sup>2</sup> U.S. Environmental Protection Agency, "Requirements for Hazardous Waste Landfill Design, Construction, and Closure" (EPA/625/4-89/022), August 1989

<sup>3</sup> Koerner, Robert M., *Designing With Geosynthetics, Fourth Edition*, Prentice Hall, 1998.

## GCL-DESIGN

Calculations for the GCL include:

- GCL settlement strain

### CHECK GCL LINER DURING SETTLEMENT

Installed Slope Height = 16 ft  
 Liner Slope = 3 :1  
 Slope Length = 50.60 ft

Maximum Anticipated Settlement = 0.5 ft  
 Final Slope Length = 50.76 ft

Settlement not calculated due to low waste fill height and shallow bedrock foundation  
 Conservative value assumed for this analysis

Strain,  $\epsilon = (50.8 - 50.6) \text{ ft} / 50.6 \text{ ft}$   
 $\epsilon_{\text{actual}} = 0.2 \text{ ft} / 50.6 \text{ ft}$   
 $\epsilon_{\text{actual}} = 0.003169 \text{ ft/ft}$   
 $\epsilon_{\text{actual}} = 0.316881 \%$   
 GCL grab elongation (e) = 50 % Not typically reported for GCL; 50% is an historic value  
 $\epsilon_{\text{allow}} = \ln(1+e) = 0.405$

$FS(\epsilon_{\text{allow}}/\epsilon_{\text{actual}}) = 128.0$  **OK**

Conclusion: Settlement of the Repository will have no detrimental effect on the GCL liner.  
 Over 30 feet of settlement would be required to reach 50% elongation

## GEOCOMPOSITE-DESIGN

Calculations for the geocomposite include:

- Geonet stress during waste placement
- Maximum fluid travel time through the geonet

Liner friction, waste, and soil properties identical to FML analysis

Additional assumptions for geonet

- Geonet thickness of 250 mil
- 8 oz geotextile heat bonded to geonet
- Geocomposite porosity of 0.7
- Geocomposite transmissivity of 1 gallon/minute/foot  
(1/2 of specified value to account for clogging and creep reductions)

### GEONET DESIGN

Normal Stress,	$\sigma_{N-ALLOWABLE} =$	200 psi	Specified
Geonet thickness, t =	t =	250 mils =	0.25 inches
$\tau_{ALLOWABLE} =$	1500 psi		
Cell Side Slope	= S =	3 : 1	
Cell Slope Angle	= $\beta =$	18.43 °	
Transmissivity,	$T_{@10,00PSF} =$	1.0 gal/min/ft	

1. Calculate the normal stress on the geonet Section 5.6.8<sup>1</sup>

$$\sigma_{N-ACTUAL} = \gamma \times (H + D)$$

$$\begin{aligned}\gamma &= 125 \text{ pcf} \\ H &= 10 \text{ ft} \\ D &= 16 \text{ ft}\end{aligned}$$

$$\begin{aligned}\sigma_{N-ACTUAL} &= 125 \text{ pcf} \times (10 \text{ ft} + 16 \text{ ft}) \\ &= 3250 \text{ psf} \\ &= 22.6 \text{ psi}\end{aligned}$$

$$\begin{aligned}FS &= 200 \text{ psf} / 22.6 \text{ psi} \\ &= 8.862 \geq 1 \text{ OK}\end{aligned}$$

2. Calculate the shear stress on the geonet Section 5.6.8<sup>1</sup>

$$\tau = F_{BELOW} / t$$

$$F_{BELOW} = 115.263 \text{ lb/ft}$$

$$\begin{aligned}\tau &= 115.2633 \text{ lb/ft} / 12 / 0.25 \text{ in} \\ &= 38.42111 \text{ psi}\end{aligned}$$

$$\begin{aligned}FS &= 1500 \text{ psi} / 38.421106 \text{ psi} \\ &= 39.041 \geq 1 \text{ OK}\end{aligned}$$

# GEOCOMPOSITE-DESIGN

3. Calculate required slope try: 2% Figure 4-15<sup>2</sup>

$t = \text{maximum travel time to LCRS trench}$   
 $= \text{Distance to sump} / \text{Seepage Velocity}$   
 $= D_{\text{slope}} / V_{\text{slope}} + D_{\text{bottom}} / V_{\text{bottom}}$

$D_{\text{slope}} = 50.60 \text{ feet}$   
 $D_{\text{bottom}} = 340 \text{ ft}$   
 $V_{\text{slope}} = T / t$

$T = f(i, \sigma)$   
 $i = 1 / \sqrt{1 + S^2}$   
 $= 1 / \sqrt{1 + 3^2}$   
 $= 0.3162278$  Factor T by: 1.5 Fig 8-10<sup>4</sup>  
 $\sigma = H / 2 * \gamma * \cos(\beta)$   
 $= 10 \text{ ft} / 2 \times 125 \text{ pcf} \times \cos(18.43^\circ)$   
 $= 592.9 \text{ psf}$  Factor T by: 0.9 Fig 8-10<sup>4</sup>  
 $T = 1.35 \text{ gal/min/ft} = 0.180 \text{ sf/min}$   
 $V_{\text{slope}} = 0.180 \text{ sf/min} / (0.25 / 12 \text{ ft})$   
 $= 8.7 \text{ ft/min}$   
 $V_{\text{bottom}} = T / t$

$T = f(i, \sigma)$   
 $i = 2\%$  Factor T by: 0.5 Fig 8-10<sup>4</sup>  
 $\sigma = \sigma_{N\text{-ACTUAL}}$   
 $= 3250 \text{ psf}$  Factor T by: 0.8 Fig 8-10<sup>4</sup>  
 $T = 0.40 \text{ gal/min/ft} = 0.0535 \text{ sf/min}$   
 $V_{\text{bottom}} = 0.1 \text{ sf/min} / (0.25 / 12 \text{ ft})$   
 $= 2.6 \text{ ft/min}$

$t = 50.6 \text{ ft} / 8.7 \text{ ft/min} + 340 \text{ ft} / 2.6 \text{ ft/min}$   
 $= 138.3 \text{ minutes}$   
 $= 2.3 \text{ hours} \leq 24 \text{ hours} \quad \underline{\text{OK}}$

**2% OK**

<sup>1</sup> Koerner, Robert M., *Designing With Geosynthetics, Second Edition*, Prentice Hall, 1990.

<sup>2</sup> U.S. Environmental Protection Agency, "Requirements for Hazardous Waste Landfill Design, Construction, and Closure" (EPA/625/4-89/022), August 1989

<sup>3</sup> Koerner, Robert M., *Designing With Geosynthetics, Fourth Edition*, Prentice Hall, 1998.

<sup>3</sup> Koerner, Robert M., *Designing With Geosynthetics, Sixth Edition*, Prentice Hall, 2012.



## ANCHORAGE-DESIGN

Calculations for the anchor include:

- Bottom Liner Anchorage

Minimum friction interface considered so calc is applicable for all geosynthetic layers

Liner friction, waste, and soil properties identical to FML analysis

### ANCHORAGE

Calculate anchor capacity for GCL placed in various anchorage configurations

Friction Angle	= $\delta_L$ =	17 °	Used Residual friction even though large displacement improbable at trench
Soil f Angle	= $\phi$ =	32 °	
Slope Angle	= $\beta$ =	18.43 °	
Soil Unit Wt	= $\gamma$ =	120 pcf	
Embedment	= $L_H$ =	2 ft	
Cover Depth	= $d_c$ =	1.8 ft	Average cover depth over runout length
Anchor Burial	= $d_{AT}$ =	2 ft	
At-rest coefficient	= $K_o$ =	0.47	
Active coefficient	= $K_A$ =	0.31	
Passive coefficient	= $K_P$ =	3.25	

$$\begin{aligned}
 q &= \gamma \times d_c \\
 &= 120 \text{ pcf} \times 1.8 \text{ ft} \\
 &= 216 \text{ psf}
 \end{aligned}$$

Anchor Trench (*Used in Design*)

Figure 3-8<sup>2</sup>

2%

$$T_A = \frac{q \times L_H \times \tan(\delta_L) + (K' + K_o) \tan(\delta_L)(0.5 \times \gamma \times d_{AT}^2 + q \times d_{AT})}{1.5 \times \cos(\beta) - \sin(\beta) \times \tan(\delta)}$$

$K' = K_o$  or  $K_P$

$$\begin{aligned}
 T_{Ap} &= \frac{216 \text{ psf} \times 2 \text{ ft} \times \tan(17^\circ) + 3.56 \times \tan(17^\circ)(0.5 \times 120 \text{ pcf} \times 2 \text{ ft}^2 + 216 \text{ psf} \times 2 \text{ ft})}{1.5 \cos(18.43^\circ) - \sin(18.43^\circ) \times \tan(17^\circ)} \\
 T_{Ap} &= \frac{651.3 \text{ lb/ft}}{83.4 \text{ lb/ft}} \geq 83.4 \text{ lb/ft} \quad \text{OK} \\
 T_{Ao} &= \frac{216 \text{ psf} \times 2 \text{ ft} \times \tan(17^\circ) + 0.78 \times \tan(17^\circ)(0.5 \times 120 \text{ pcf} \times 2 \text{ ft}^2 + 216 \text{ psf} \times 2 \text{ ft})}{1.5 \cos(18.43^\circ) - \sin(18.43^\circ) \times \tan(17^\circ)} \\
 T_{Ao} &= \frac{220.0 \text{ lb/ft}}{83.4 \text{ lb/ft}} \geq 83.4 \text{ lb/ft} \quad \text{OK}
 \end{aligned}$$

<sup>2</sup> U.S. Environmental Protection Agency, "Requirements for Hazardous Waste Landfill Design, Construction, and Closure" (EPA/625/4-89/022), August 1989

# Seismic Displacement FML vs GCL/Geocomposite (weakest interface)

## Seismic analysis<sup>1</sup>

Liner Friction Angle	= $\delta$ =	17 °	
Weight of Soil	= $\gamma$ =	125 pcf	
Cap Slope Angle	= $\beta_2$ =	18.43 °	0.321751 radians
Cap Slope	= $S_2$ =	3 :1	
Slope Length	= $L$ =	50.6 ft	
Slope height		16.0 ft	
Cover Thickness	= $h$ =	5 ft	Cushion plus one waste lift (calculation is more conservative with thin cover)
Soil Friction Angle	= $\phi$ =	30 °	
Interface Cohesion	= $c_a$ =	0 psf	
Cohesive Force	= $C_a$ =	0.0 lb/ft	

Cs                      0.115 g                      Find yield acceleration resulting in FS = 1

Wa=                      total weight of active wedge  
 Wa=                       $\gamma h^2(L/h-1/\sin\beta-\tan\beta/2)$   
 Wa=                      21219.8 lb/ft

Na=                      effective force normal to the failure plane of the active wedge  
 Na=                       $W_a \cos\beta$   
 Na=                      20130.9 lb/ft

Wp=                      total weight of passive wedge  
 Wp=                       $\gamma h^2/\sin 2\beta$   
 Wp=                      5208.3 lb/ft

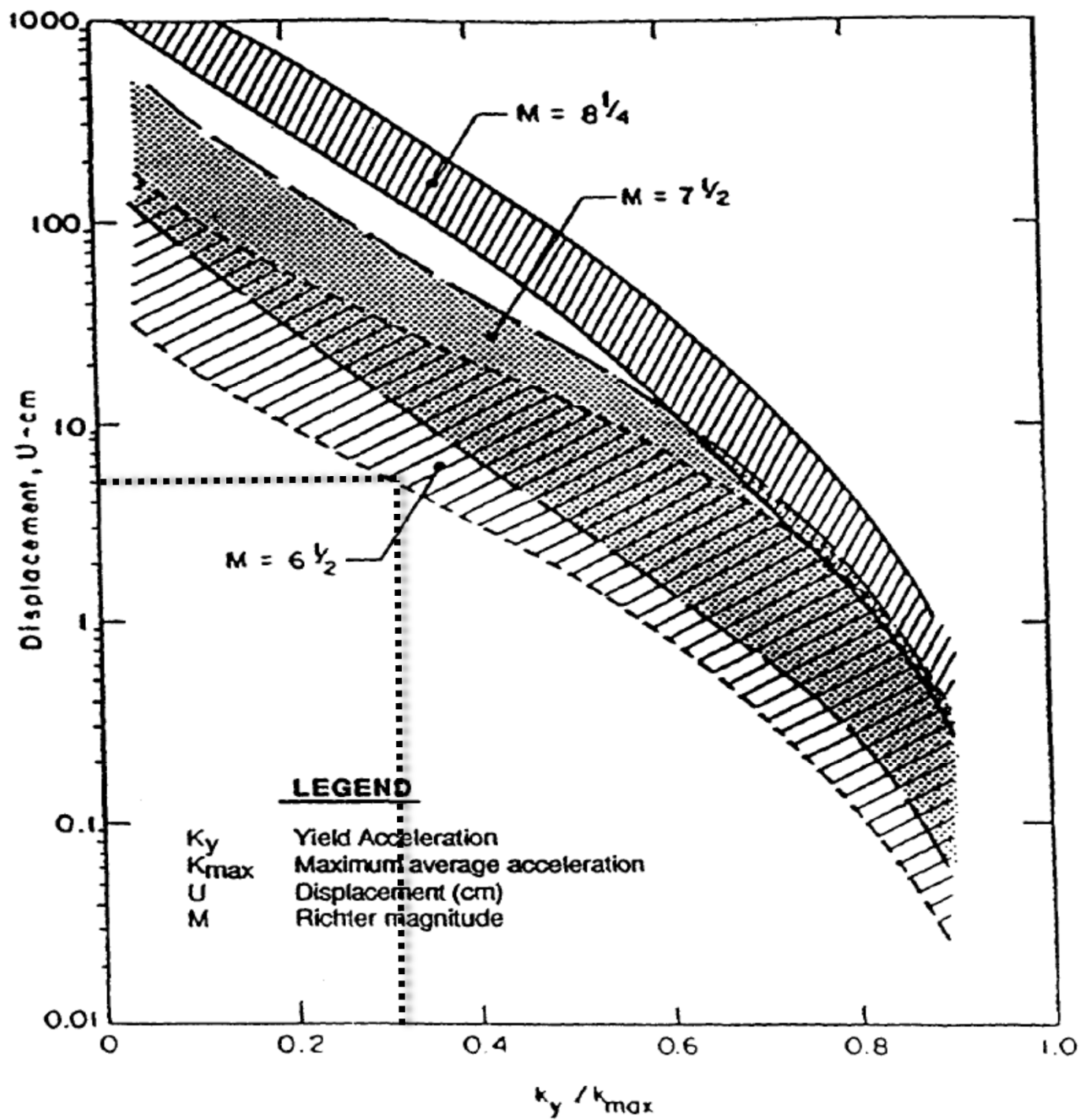
a =                       $(C_s W_a + N_a \sin\beta) \cos\beta + C_s W_p \cos\beta$   
 a=                      8922.543 lb/ft  
 b=                       $-[(C_s W_a + N_a \sin\beta) \sin\beta \tan\phi + (N_a \tan\delta + C_a) \cos^2\beta + \cos\beta (C + W_p \tan\phi)]$   
 b=                      -9999.68 lb/ft  
 c=                       $(N_a \tan\delta + C_a) \cos\beta \sin\beta \tan\phi$   
 c=                      1066.014 lb/ft

FS =                       $[-b + (b^2 - 4ac)^{0.5}] / 2a$   
 FS =                      1.00

Yield Acceleration (ky) =                      0.115  
 PGA (kmax) =                      0.37  
 ky / kmax =                      0.31  
 Magnitude =                      6.3

Estimated displacement =                      5 cm =                      2.0 in                      Read from chart below

Displacement of 2 inches is acceptable for the design seismic event



Maddisi and Seed Permanent Displacement Chart (Makdisi and Seed, 1987)

<sup>1</sup> Koerner, Robert M., *Designing With Geosynthetics, Fourth Edition*, Prentice Hall, 1998 pg. 481.

<sup>2</sup> Test data from manufacturers and other projects

# Unified Hazard Tool



- Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the [U.S. Seismic Design Maps web tools](#) (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

## ^ Input

### Edition

Dynamic: Conterminous U.S. 2014

### Spectral Period

Peak ground acceleration

### Latitude

Decimal degrees

42.6868

### Time Horizon

Return period in years

2475

### Longitude

Decimal degrees, negative values for western long...

-111.5679

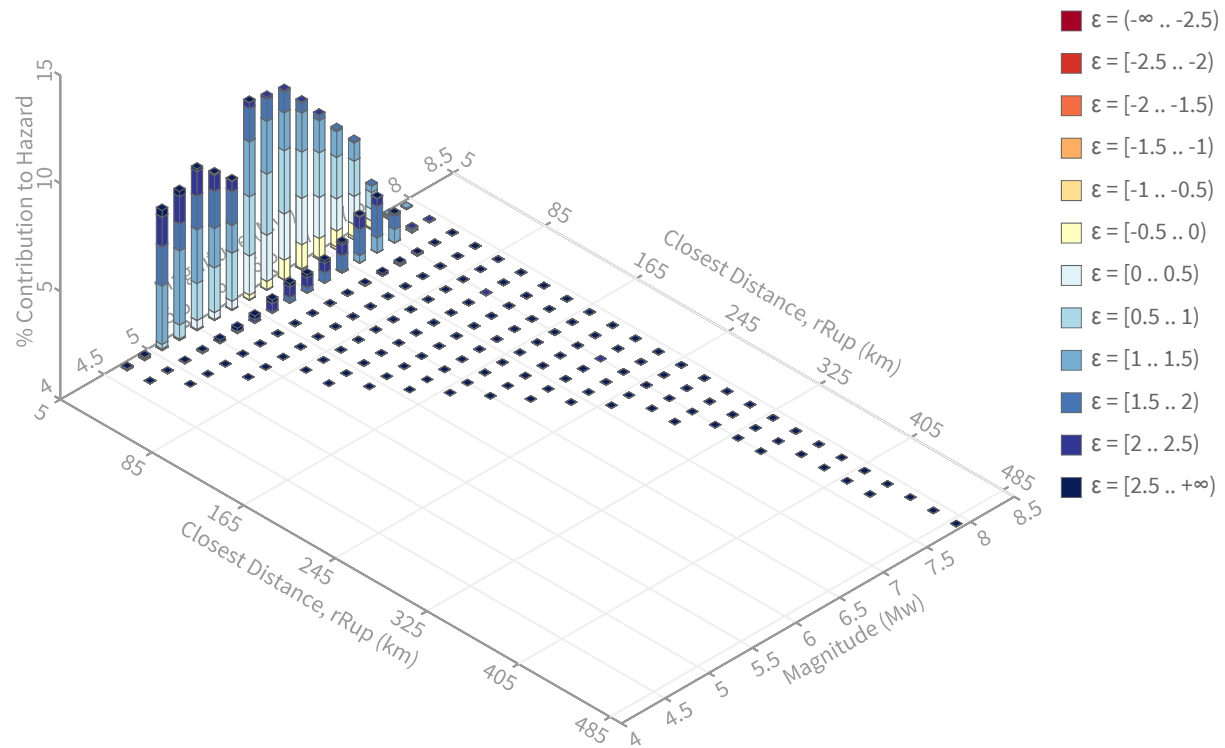
### Site Class

760 m/s (B/C boundary)

## ^ Deaggregation

### Component

Total



## Summary statistics for, Deaggregation: Total

### Deaggregation targets

---

**Return period:** 2475 yrs

**Exceedance rate:** 0.0004040404 yr<sup>-1</sup>

**PGA ground motion:** 0.37608098 g

### Recovered targets

---

**Return period:** 2644.2747 yrs

**Exceedance rate:** 0.00037817553 yr<sup>-1</sup>

### Totals

---

**Binned:** 100 %

**Residual:** 0 %

**Trace:** 0.76 %

### Mean (for all sources)

---

**r:** 12.14 km

**m:** 6.28

**$\epsilon_0$ :** 1.1  $\sigma$

### Mode (largest r-m bin)

---

**r:** 9.8 km

**m:** 6.1

**$\epsilon_0$ :** 0.98  $\sigma$

**Contribution:** 9.14 %

### Mode (largest $\epsilon_0$ bin)

---

## Static Analysis with 2 Feet of Cover Soil

### SLIDING<sup>1</sup>

Verify that soil cover will not slide on FML (FS>1.5)

Liner Friction Angle	= $\delta$ =	30 ° <sup>2</sup>	Large displacement value
Weight of Soil	= $\gamma$ =	120 pcf	
Cap Slope Angle	= $\beta_2$ =	11.31 °	
Cap Slope	= $S_2$ =	5 :1	
Slope Length	= $L$ =	107.1 ft	
Slope Height		21 ft	
Cover Thickness	= $h$ =	2 ft	
Soil Friction Angle	= $\phi$ =	32 °	
Interface Cohesion	= $c_a$ =	0 psf	
Cohesive Force	= $C_a$ =	0 lb/ft	
Assume $C = 0$			

Wa= total weight of active wedge

Wa=  $\gamma h^2(L/h-1/\sin\beta-\tan\beta/2)$

Wa= 23203.53 lb/ft

Na= effective force normal to the failure plane of the active wedge

Na=  $W_a \cos\beta$

Na= 22752.93 lb/ft

Wp= total weight of passive wedge

Wp=  $\gamma h^2/\sin 2\beta$

Wp= 1248 lb/ft

a =  $(W_a - N_a \cos\beta) \cos\beta$

a= 875.1128 lb/ft

b=  $-[(W_a - N_a \cos\beta) \sin\beta \tan\phi + (N_a \tan\delta + C_a) \sin\beta \cos\beta + \sin\beta (C + W_p \tan\phi)]$

b= -2788.54 lb/ft

c=  $(N_a \tan\delta + C_a) \sin^2\beta \tan\phi$

c= 315.7131 lb/ft

FS =  $[-b + (b^2 - 4ac)^{.5}]/2a$

FS = 3.07 **OK**

<sup>1</sup> Koerner, Robert M., *Designing With Geosynthetics, Fourth Edition*, Prentice Hall, 1998 pg. 481.

<sup>2</sup> Test data from manufacturers and other projects

# Seismic Analysis with 2 Feet of Cover Soil

Seismic<sup>1</sup>

Verify that soil cover will not slide on FML (FS>1)

Liner Friction Angle	= $\delta$ =	30 ° <sup>2</sup>	Large displacement value
Weight of Soil	= $\gamma$ =	120 pcf	
Cap Slope Angle	= $\beta_2$ =	11.31 °	
Cap Slope	= $S_2$ =	5 :1	
Slope Length	= $L$ =	107.1 ft	
Slope height		21 ft	
Cover Thickness	= $h$ =	2 ft	
Soil Friction Angle	= $\phi$ =	32 °	
Interface Cohesion	= $c_a$ =	0 psf	
Cohesive Force	= $C_a$ =	0.0 lb/ft	
Assume C = 0			

Cs                      0.37 g                      Design PGA, no reduction for landfill height

Wa=            total weight of active wedge  
 Wa=             $\gamma h^2(L/h-1/\sin\beta-\tan\beta/2)$   
 Wa=            23203.5 lb/ft

Na=            effective force normal to the failure plane of the active wedge  
 Na=             $W_a \cos\beta$   
 Na=            22752.9 lb/ft

Wp=            total weight of passive wedge  
 Wp=             $\gamma h^2/\sin 2\beta$   
 Wp=            1248.0 lb/ft

a =             $(C_s \cdot W_a + N_a \cdot \sin\beta) \cdot \cos\beta + C_s \cdot W_p \cdot \cos\beta$   
 a=            13246.94 lb/ft

b=             $-[(C_s \cdot W_a + N_a \cdot \sin\beta) \cdot \sin\beta \cdot \tan\phi + (N_a \cdot \tan\delta + C_a) \cdot \cos^2\beta + \cos\beta(C + W_p \cdot \tan\phi)]$   
 b=            -14994.8 lb/ft

c=             $(N_a \cdot \tan\delta + C_a) \cdot \cos\beta \cdot \sin\beta \cdot \tan\phi$   
 c=            1578.566 lb/ft

FS =             $[-b + (b^2 - 4ac)^{.5}]/2a$   
 FS =            1.01 'OK'

<sup>1</sup> Koerner, Robert M., *Designing With Geosynthetics, Fourth Edition*, Prentice Hall, 1998 pg. 481.

<sup>2</sup> Test data from manufacturers and other projects



# Construction Analysis with 1.5 Feet of Cover Soil

Equipment on Slope, No Acceleration<sup>1</sup>

Verify that soil cover will not slide on FML (FS>1.5)

Liner Friction Angle	= $\delta$ =	30 ° <sup>2</sup>	Large displacement value
Weight of Soil	= $\gamma$ =	130 pcf	
Cap Slope Angle	= $\beta_2$ =	11.31 °	
Cap Slope	= $S_2$ =	5 :1	
Slope Length	= $L$ =	107.1 ft	
Slope Height		21 ft	
Cover Thickness	= $h$ =	1.5 ft	
Soil Friction Angle	= $\phi$ =	32 °	
Interface Cohesion	= $c_a$ =	0 psf	
Cohesive Force	= $C_a$ =	0.0 lb/ft	

## Equipment - D8 Dozer Specs

Weight	82500 lb	Cat D8T LGP
Load	1010 psf	7 psi max specified

Wa= total weight of active wedge  
 Wa=  $gh^2(L/h-1/\sin\beta-\tan\beta/2)$   
 Wa= 19359.77 lb/ft

We= total weight of equipment  
 We= 82500 Entire equipment weight (ignores soil bearing capacity)

Na= effective force normal to the failure plane of the active wedge  
 Na=  $Wa*\cos\beta$   
 Na= 18983.82 lb/ft

Ne= effective force normal to the failure plane of the equipment  
 Ne=  $We*\cos\beta$   
 Ne= 80897.91

Wp= total weight of passive wedge  
 Wp=  $\gamma h^2/\sin 2\beta$   
 Wp= 760.5 lb/ft

a =  $((Wa+We)*\sin\beta)*\cos\beta$   
 a= 19588.42 lb/ft  
 b=  $-([(Wa+We)*\sin\beta]*\sin\beta*\tan\phi+((Na+Ne)*\tan\delta+Ca)*\cos\beta+(C+Wp*\tan\phi)]$   
 b= -59470.1 lb/ft  
 c=  $((Na+Ne)*\tan\delta+Ca)*\sin\beta*\tan\phi$   
 c= 7066.884 lb/ft

FS =  $[-b+(b^2-4ac)^{.5}]/2a$   
 FS = 2.91 **OK** (FS slightly higher with 2 ft cover)

<sup>1</sup> Koerner, Robert M., *Designing With Geosynthetics, Fourth Edition*, Prentice Hall, 1998 pg. 481.

<sup>2</sup> Various test data from other projects and research



## **Microspike Textured Geomembrane**

**Representative Interface Shear Values**

**Cap Loading Conditions**

**ASTM D 5321**

### **Soil/Microspike Surface**

• Coarse Sand	34° P	34° LD	92% Efficiency
• Lean Clay	37° P	32° LD	97% Efficiency
• Silty Sand	32° P	28° LD	100% Efficiency
• NW GT	32° P	17° LD	NA

**Notes:** The above values are representative friction angles only. It is recommended that site specific conformance testing be carried out using the actual soils, geosynthetics and loading conditions for a specific project.

**P = Maximum or Peak Interface Shear Value in Degrees**

**LD = Large Displacement Interface Shear Value in Degrees**

**NW GT = Non Woven Needle punched Geotextile on a Geonet Composite**

**Cap Loads Used in Testing: 250, 500, 1000 psf**

**Efficiency:  $E\phi = (\tan \delta / \tan \phi) 100$  (comparison of internal soil peak shear ( $\phi$ ) vs interface peak shear ( $\delta$ ))**

**HYDRAULIC AND HYDROLOGIC CALCULATIONS  
AND MODEL OUTPUT**

# Waste Drainage

```
*****
*****
**
**
**
**      HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
**      HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)
**      DEVELOPED BY ENVIRONMENTAL LABORATORY
**      USAE WATERWAYS EXPERIMENT STATION
**      FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
**
**
*****
*****
```

TITLE: Soda Springs Repository - Waste Drainage

\*\*\*\*\*

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER  
WERE SPECIFIED BY THE USER.

## LAYER 1

-----

### TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 6

THICKNESS	=	84.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

## LAYER 2

-----

### TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	36.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.719999988000E-02	CM/SEC

## LAYER 3

-----

### TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL

Waste Drainage

INITIAL SOIL WATER CONTENT	=	0.0100 VOL/VOL	
EFFECTIVE SAT. HYD. COND.	=	3.15000010000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	325.0	FEET

#### LAYER 4

-----

##### TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

#### LAYER 5

-----

##### TYPE 3 - BARRIER SOIL LINER

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999994000E-08	CM/SEC

#### LAYER 6

-----

##### TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 23

THICKNESS	=	6.00	INCHES
POROSITY	=	0.4610	VOL/VOL
FIELD CAPACITY	=	0.3600	VOL/VOL
WILTING POINT	=	0.2030	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.900000032000E-05	CM/SEC

#### GENERAL DESIGN AND EVAPORATIVE ZONE DATA

-----

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT  
SOIL DATA BASE USING SOIL TEXTURE # 6 WITH BARE  
GROUND CONDITIONS, A SURFACE SLOPE OF 2. % AND

Waste Drainage  
A SLOPE LENGTH OF 350. FEET.

SCS RUNOFF CURVE NUMBER	=	85.60	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	7.500	ACRES
EVAPORATIVE ZONE DEPTH	=	0.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	0.000	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	0.000	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.000	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	34.090	INCHES
TOTAL INITIAL WATER	=	34.090	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA  
-----

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM  
POCATELLO IDAHO

STATION LATITUDE	=	42.69	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	200	
END OF GROWING SEASON (JULIAN DATE)	=	201	
EVAPORATIVE ZONE DEPTH	=	0.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	0.00	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	52.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	43.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	65.00	%

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING  
COEFFICIENTS FOR POCATELLO IDAHO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
23.80	29.50	35.50	44.60	54.00	62.50
71.20	68.90	59.20	48.10	35.20	26.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING  
COEFFICIENTS FOR POCATELLO IDAHO  
AND STATION LATITUDE = 42.69 DEGREES

\*\*\*\*\*

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	0.00	0.000	100.00
RUNOFF	0.000	0.000	??????????

	Waste Drainage		
EVAPOTRANSPIRATION	0.000	4.728	+++++++
DRAINAGE COLLECTED FROM LAYER 3	9.5402	259731.203	+++++++
PERC./LEAKAGE THROUGH LAYER 5	0.000022	0.593	+++++++
AVG. HEAD ON TOP OF LAYER 4	0.0621		
PERC./LEAKAGE THROUGH LAYER 6	0.010422	283.731	+++++++
CHANGE IN WATER STORAGE	-9.551	-260019.766	-----
SOIL WATER AT START OF YEAR	34.090	928098.562	
SOIL WATER AT END OF YEAR	24.539	668078.812	
SNOW WATER AT START OF YEAR	0.000	0.000	????????
SNOW WATER AT END OF YEAR	0.000	0.000	????????
ANNUAL WATER BUDGET BALANCE	0.0000	0.102	+++++++

\*\*\*\*\*

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1				
	INCHES		CU. FEET	PERCENT
PRECIPITATION	0.00	( 0.000)	0.0	100.00
RUNOFF	0.000	( 0.0000)	0.00	????????
EVAPOTRANSPIRATION	0.000	( 0.0000)	4.73	+++++++
LATERAL DRAINAGE COLLECTED FROM LAYER 3	9.54017	( 0.00000)	259731.203	+++++++
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00002	( 0.00000)	0.593	+++++++
AVERAGE HEAD ON TOP OF LAYER 4	0.062	( 0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.01042	( 0.00000)	283.731	+++++++
CHANGE IN WATER STORAGE	-9.551	( 0.0000)	-260019.77	-----

\*\*\*\*\*

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1		
	(INCHES)	(CU. FT.)
PRECIPITATION	0.00	0.000
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.28672	7805.86279
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000005	0.13761
AVERAGE HEAD ON TOP OF LAYER 4	5.064	

# Waste Drainage

MAXIMUM HEAD ON TOP OF LAYER	4	8.198	
LOCATION OF MAXIMUM HEAD IN LAYER	3		
(DISTANCE FROM DRAIN)		61.8 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER	6	0.000030	0.82792
SNOW WATER		0.00	0.0000
MAXIMUM VEG. SOIL WATER (VOL/VOL)			0.3000
MINIMUM VEG. SOIL WATER (VOL/VOL)			0.0850

\*\*\* Maximum heads are computed using McEnroe's equations. \*\*\*

Reference: Maximum Saturated Depth over Landfill Liner  
by Bruce M. McEnroe, University of Kansas  
ASCE Journal of Environmental Engineering  
Vol. 119, No. 2, March 1993, pp. 262-270.



## Capacity of LCRS system

### LCRS Storage Volume

Maximum head on bottom liner	1 ft	Excludes leachate trench
Maximum elevation to generate 1 ft of head on liner	6024 ft	
Volume below maximum elevation	39,258 ft <sup>3</sup>	From design surface
Assumed effective porosity in drain gravel & cushion layer	25 %	
Leachate storage volume	9814.5 ft <sup>3</sup>	= 73,422 gallons

### Leachate Conveyance

Maximum Drainage Rate (HELP3)	7,806 ft <sup>3</sup> /day	= 40.5 gal/min
Length of Trench	1090 ft	
Maximum flow rate to LCRS trench	0.04 gal/min/ft	< 1 gal/min/ft <b>OK</b>

### LCRS Drain Pipe Capacity

Manning's n	0.015	Plastics Pipe Institute
Diameter	4 in	
Pipe Area	0.0873 ft <sup>2</sup>	
Pipe Perimeter	1.0472 ft	
Slope	0.5 %	= 0.005 ft/ft
Gravity flow by Manning's equation	0.1166 cfs	= 52.3 gal/min

### Perforated Pipe Orifice Flow

Orifice area	1 in <sup>2</sup> /ft (min)	AASHTO M252
Pipe Length	1,090 ft	
Total Orifice Area	7.6 ft <sup>2</sup>	
Head on orifices with water 3 in above pipe	3 in	= 0.25 ft
Orifice coefficient	0.6	

$$Q = C_x A_x \sqrt{2gh} = 18.22 \text{ cfs} = 8,179 \text{ gpm}$$

Therefore, orifice flow is not limiting

Bare Cover Soil

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**
**      HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
**      HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)
**      DEVELOPED BY ENVIRONMENTAL LABORATORY
**      USAE WATERWAYS EXPERIMENT STATION
**      FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
**
**
*****
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TITLE: Soda Springs Repository - Bare Cover

\*\*\*\*\*

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER  
WERE SPECIFIED BY THE USER.

LAYER 1

-----

TYPE 1 - VERTICAL PERCOLATION LAYER

MATERIAL TEXTURE NUMBER 9

THICKNESS	=	24.00	INCHES
POROSITY	=	0.5010	VOL/VOL
FIELD CAPACITY	=	0.2840	VOL/VOL
WILTING POINT	=	0.1350	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.190000006000E-03	CM/SEC

LAYER 2

-----

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	3.15000010000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	325.0	FEET

LAYER 3

-----

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
-----------	---	------	--------

	Bare Cover Soil	
POROSITY	=	0.0000 VOL/VOL
FIELD CAPACITY	=	0.0000 VOL/VOL
WILTING POINT	=	0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

#### LAYER 4

-----

	TYPE 3 - BARRIER SOIL LINER	
	MATERIAL TEXTURE NUMBER	0
THICKNESS	=	0.25 INCHES
POROSITY	=	0.7500 VOL/VOL
FIELD CAPACITY	=	0.7470 VOL/VOL
WILTING POINT	=	0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999994000E-08 CM/SEC

#### LAYER 5

-----

	TYPE 1 - VERTICAL PERCOLATION LAYER	
	MATERIAL TEXTURE NUMBER	0
THICKNESS	=	12.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.719999988000E-02 CM/SEC

#### LAYER 6

-----

	TYPE 1 - VERTICAL PERCOLATION LAYER	
	MATERIAL TEXTURE NUMBER	6
THICKNESS	=	192.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

#### LAYER 7

-----

	TYPE 2 - LATERAL DRAINAGE LAYER	
	MATERIAL TEXTURE NUMBER	0
THICKNESS	=	36.00 INCHES

Bare Cover Soil

POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.719999988000E-02	CM/SEC

LAYER 8

-----

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	3.15000010000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	325.0	FEET

LAYER 9

-----

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 10

-----

TYPE 3 - BARRIER SOIL LINER

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999994000E-08	CM/SEC

LAYER 11

-----

TYPE 1 - VERTICAL PERCOLATION LAYER

Bare Cover Soil  
MATERIAL TEXTURE NUMBER 23

THICKNESS	=	6.00	INCHES
POROSITY	=	0.4610	VOL/VOL
FIELD CAPACITY	=	0.3600	VOL/VOL
WILTING POINT	=	0.2030	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.900000032000E-05	CM/SEC

#### GENERAL DESIGN AND EVAPORATIVE ZONE DATA

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NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT  
SOIL DATA BASE USING SOIL TEXTURE # 9 WITH BARE  
GROUND CONDITIONS, A SURFACE SLOPE OF 2. % AND  
A SLOPE LENGTH OF 325. FEET.

SCS RUNOFF CURVE NUMBER	=	91.70	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	7.500	ACRES
EVAPORATIVE ZONE DEPTH	=	16.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	4.000	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	8.016	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.160	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	55.880	INCHES
TOTAL INITIAL WATER	=	55.880	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

#### EVAPOTRANSPIRATION AND WEATHER DATA

-----

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM  
POCATELLO IDAHO

STATION LATITUDE	=	42.69	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	132	
END OF GROWING SEASON (JULIAN DATE)	=	275	
EVAPORATIVE ZONE DEPTH	=	16.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.20	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	52.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	43.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	65.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING  
COEFFICIENTS FOR POCATELLO IDAHO

#### NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
-----	-----	-----	-----	-----	-----
1.14	1.27	1.42	1.35	2.13	1.36
1.25	1.31	1.07	1.26	1.16	1.03

# Bare Cover Soil

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING  
COEFFICIENTS FOR POCATELLO IDAHO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
23. 80	29. 50	35. 50	44. 60	54. 00	62. 50
71. 20	68. 90	59. 20	48. 10	35. 20	26. 60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING  
COEFFICIENTS FOR POCATELLO IDAHO  
AND STATION LATITUDE = 42. 69 DEGREES

\*\*\*\*\*

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES	CU. FEET	PERCENT
PRECIPITATION	15. 62 ( 3. 010)	425189. 2	100. 00
RUNOFF	1. 805 ( 0. 9865)	49152. 60	11. 560
EVAPOTRANSPIRATION	13. 477 ( 2. 3680)	366908. 06	86. 293
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0. 33763 ( 0. 38211)	9192. 102	2. 16188
PERCOLATION/LEAKAGE THROUGH LAYER 4	0. 00000 ( 0. 00000)	0. 021	0. 00001
AVERAGE HEAD ON TOP OF LAYER 3	0. 001 ( 0. 001)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0. 02400 ( 0. 19498)	653. 405	0. 15367
PERCOLATION/LEAKAGE THROUGH LAYER 10	0. 00000 ( 0. 00000)	0. 018	0. 00000
AVERAGE HEAD ON TOP OF LAYER 9	0. 000 ( 0. 000)		
PERCOLATION/LEAKAGE THROUGH LAYER 11	0. 00131 ( 0. 00119)	35. 765	0. 00841
CHANGE IN WATER STORAGE	-0. 028 ( 0. 8159)	-752. 86	-0. 177

\*\*\*\*\*

PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT. )
PRECIPITATION	2. 64	71874. 000
RUNOFF	1. 658	45128. 0859

Bare Cover Soil

DRAINAGE COLLECTED FROM LAYER 2	0.21185	5767.58203
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000000	0.00313
AVERAGE HEAD ON TOP OF LAYER 3	0.193	
MAXIMUM HEAD ON TOP OF LAYER 3	0.377	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	6.9 FEET	
DRAINAGE COLLECTED FROM LAYER 8	0.05166	1406.33533
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00086
AVERAGE HEAD ON TOP OF LAYER 9	0.047	
MAXIMUM HEAD ON TOP OF LAYER 9	0.094	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.7 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.000030	0.82818
SNOW WATER	3.36	91377.7734
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.3845
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.1350

\*\*\* Maximum heads are computed using McEnroe's equations. \*\*\*

Reference: Maximum Saturated Depth over Landfill Liner  
by Bruce M. McEnroe, University of Kansas  
ASCE Journal of Environmental Engineering  
Vol. 119, No. 2, March 1993, pp. 262-270.

Good Cover Soil

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**
**      HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE      **
**      HELP MODEL VERSION 3.07 (1 NOVEMBER 1997)            **
**      DEVELOPED BY ENVIRONMENTAL LABORATORY                 **
**      USAE WATERWAYS EXPERIMENT STATION                     **
**      FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
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TITLE: Soda Springs Repository - Good Cover

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER  
WERE SPECIFIED BY THE USER.

SOIL LAYERS IDENTICAL TO BARE COVER SOIL SIMULATION

-----  
GENERAL DESIGN AND EVAPORATIVE ZONE DATA  
-----

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT  
SOIL DATA BASE USING SOIL TEXTURE # 9 WITH A  
GOOD STAND OF GRASS, A SURFACE SLOPE OF 2. %  
AND A SLOPE LENGTH OF 325. FEET.

SCS RUNOFF CURVE NUMBER	=	75.10	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	7.500	ACRES
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	6.000	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	12.024	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	3.240	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	55.880	INCHES
TOTAL INITIAL WATER	=	55.880	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

-----  
EVAPOTRANSPIRATION AND WEATHER DATA  
-----

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM  
POCATELLO IDAHO

STATION LATITUDE	=	42.69	DEGREES
MAXIMUM LEAF AREA INDEX	=	1.20	
START OF GROWING SEASON (JULIAN DATE)	=	132	
END OF GROWING SEASON (JULIAN DATE)	=	275	
EVAPORATIVE ZONE DEPTH	=	24.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	10.20	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00	%



Good Cover Soil

AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	52.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	43.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	65.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING  
COEFFICIENTS FOR POCATELLO IDAHO

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
-----	-----	-----	-----	-----	-----
1.14	1.27	1.42	1.35	2.13	1.36
1.25	1.31	1.07	1.26	1.16	1.03

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING  
COEFFICIENTS FOR POCATELLO IDAHO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
-----	-----	-----	-----	-----	-----
23.80	29.50	35.50	44.60	54.00	62.50
71.20	68.90	59.20	48.10	35.20	26.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING  
COEFFICIENTS FOR POCATELLO IDAHO  
AND STATION LATITUDE = 42.69 DEGREES

\*\*\*\*\*

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100				
	INCHES		CU. FEET	PERCENT
	-----	-----	-----	-----
PRECIPITATION	15.62	( 3.010)	425189.2	100.00
RUNOFF	0.517	( 0.5246)	14072.31	3.310
EVAPOTRANSPIRATION	14.913	( 2.6171)	406002.22	95.487
LATERAL DRAINAGE COLLECTED FROM LAYER 2	0.21265	( 0.46603)	5789.395	1.36160
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00000	( 0.00000)	0.023	0.00001
AVERAGE HEAD ON TOP OF LAYER 3	0.001	( 0.005)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.02400	( 0.19498)	653.410	0.15368
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	( 0.00000)	0.014	0.00000
AVERAGE HEAD ON TOP	0.000	( 0.000)		

OF LAYER 9

Good Cover Soil

PERCOLATION/LEAKAGE THROUGH LAYER 11 0.00118 ( 0.00114) 32.215 0.00758

CHANGE IN WATER STORAGE -0.050 ( 1.0149) -1360.40 -0.320

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	2.64	71874.000
RUNOFF	1.164	31683.1855
DRAINAGE COLLECTED FROM LAYER 2	0.27462	7476.49121
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000003	0.08706
AVERAGE HEAD ON TOP OF LAYER 3	3.423	
MAXIMUM HEAD ON TOP OF LAYER 3	5.795	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)	49.8 FEET	
DRAINAGE COLLECTED FROM LAYER 8	0.05166	1406.33533
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00086
AVERAGE HEAD ON TOP OF LAYER 9	0.047	
MAXIMUM HEAD ON TOP OF LAYER 9	0.094	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.7 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.000030	0.82818
SNOW WATER	3.36	91377.7734
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.3715
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.1350

\*\*\* Maximum heads are computed using McEnroe's equations. \*\*\*

Reference: Maximum Saturated Depth over Landfill Liner  
by Bruce M. McEnroe, University of Kansas  
ASCE Journal of Environmental Engineering  
Vol. 119, No. 2, March 1993, pp. 262-270.

### Capacity of Toe Drain

Maximum Subsurface Drainage Rate (HELP3)	7476 ft <sup>3</sup> /day	=	38.8 gal/min
Length of Trench	1100 ft		North perimeter
Maximum leakage rate to the Sump	0.04 gal/min/ft	< 1	gal/min/ft <b>OK</b>

### Toe Drain Pipe Capacity

Manning's n	0.015	Plastics Pipe Institute	
Diameter	4 in		
Pipe Area	0.0873 ft <sup>2</sup>		
Pipe Perimeter	1.0472 ft		
Slope	0.5 %	=	0.005 ft/ft
Gravity flow by Manning's equation	0.1166 cfs	=	52.3 gal/min

### Perforated Pipe Orifice Flow

Orifice area	1 in <sup>2</sup> /ft (min)	AASHTO M252	
Pipe Length	1100 ft		
Total Orifice Area	7.6 ft <sup>2</sup>		
Head on orifices with water 1 in above pipe	1 in	=	0.08 ft
Orifice coefficient	0.6		

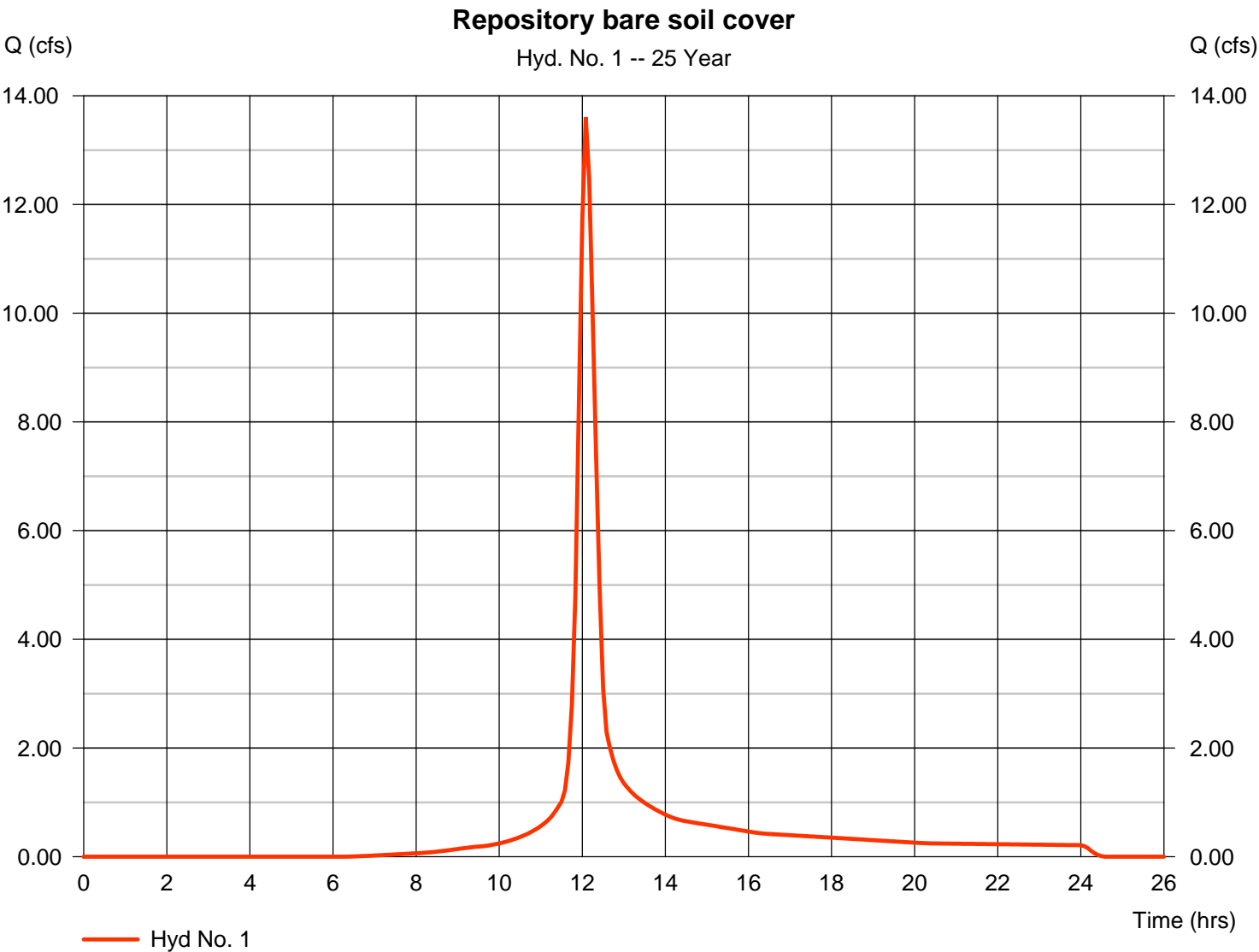
$Q = C_x A_x \sqrt{2gh} =$  10.62 cfs = 4,765 gpm  
Therefore, orifice flow is not limiting

# Hydrograph Report

## Hyd. No. 1

Repository bare soil cover

Hydrograph type	=	SCS Runoff	Peak discharge	=	13.61 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.08 hrs
Time interval	=	5 min	Hyd. volume	=	48,073 cuft
Drainage area	=	9.500 ac	Curve number	=	91.7
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	23.30 min
Total precip.	=	2.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

## Hyd. No. 1

Repository bare soil cover

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>			
<b>Sheet Flow</b>							
Manning's n-value	= 0.011	0.011	0.011				
Flow length (ft)	= 300.0	50.0	0.0				
Two-year 24-hr precip. (in)	= 1.41	1.41	0.00				
Land slope (%)	= 2.00	20.00	0.00				
<b>Travel Time (min)</b>	<b>= 4.40</b>	<b>+</b>	<b>0.42</b>	<b>+</b>	<b>0.00</b>	<b>=</b>	<b>4.81</b>
<b>Shallow Concentrated Flow</b>							
Flow length (ft)	= 1500.00	0.00	0.00				
Watercourse slope (%)	= 0.70	0.00	0.00				
Surface description	= Unpaved	Paved	Paved				
Average velocity (ft/s)	=1.35	0.00	0.00				
<b>Travel Time (min)</b>	<b>= 18.52</b>	<b>+</b>	<b>0.00</b>	<b>+</b>	<b>0.00</b>	<b>=</b>	<b>18.52</b>
<b>Channel Flow</b>							
X sectional flow area (sqft)	= 0.00	0.00	0.00				
Wetted perimeter (ft)	= 0.00	0.00	0.00				
Channel slope (%)	= 0.00	0.00	0.00				
Manning's n-value	= 0.015	0.015	0.015				
Velocity (ft/s)	=0.00	0.00	0.00				
Flow length (ft)	((0))0.0	0.0	0.0				
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b>	<b>0.00</b>	<b>+</b>	<b>0.00</b>	<b>=</b>	<b>0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>23.33 min</b>			

# Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

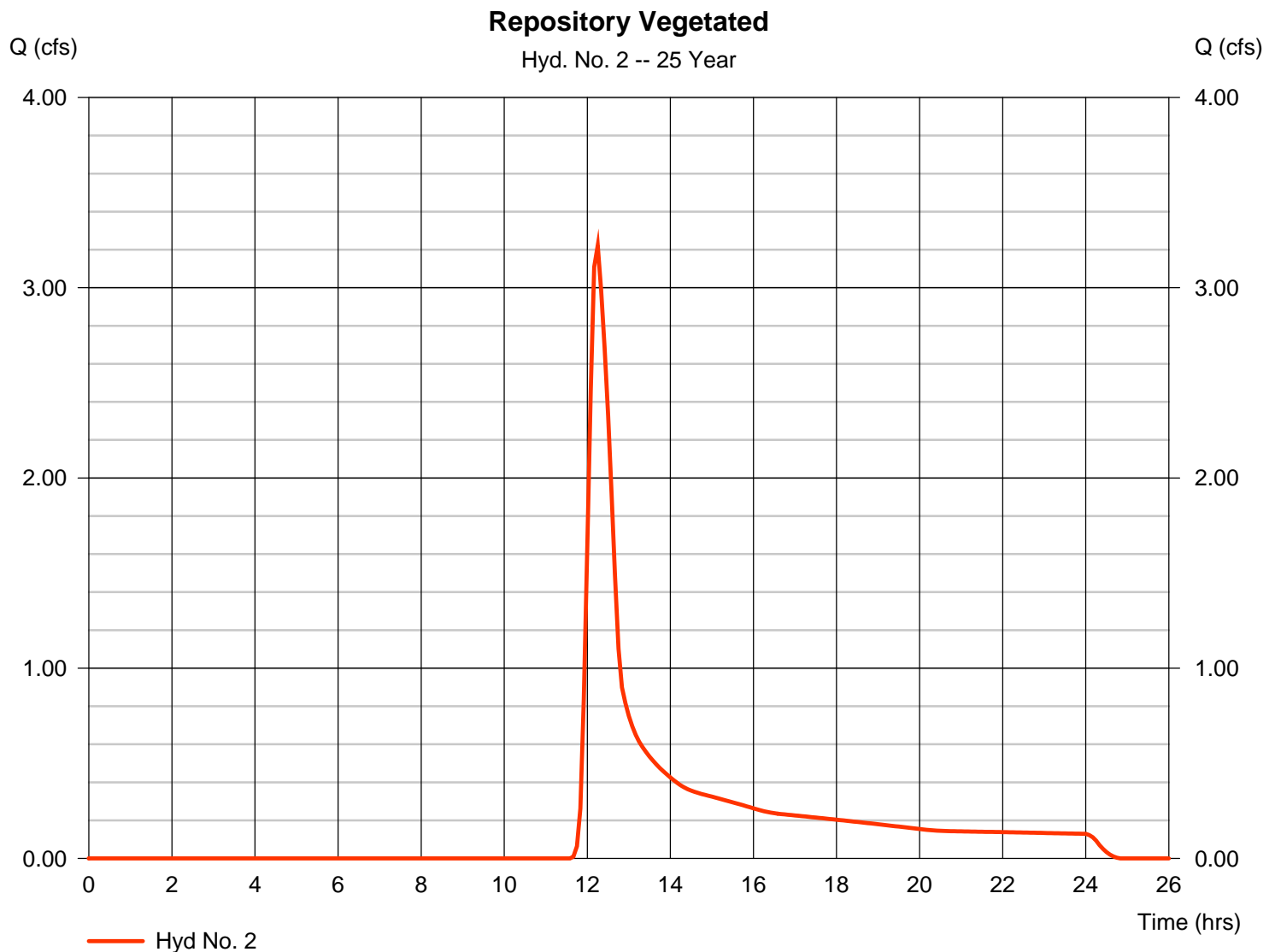
Thursday, 03 / 1 / 2018

## Hyd. No. 2

Repository Vegetated

Hydrograph type = SCS Runoff  
Storm frequency = 25 yrs  
Time interval = 5 min  
Drainage area = 9.500 ac  
Basin Slope = 0.0 %  
Tc method = TR55  
Total precip. = 2.20 in  
Storm duration = 24 hrs

Peak discharge = 3.221 cfs  
Time to peak = 12.25 hrs  
Hyd. volume = 17,311 cuft  
Curve number = 75.1  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 25.00 min  
Distribution = Type II  
Shape factor = 484



# TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2016 by Autodesk, Inc. v10.5

## Hyd. No. 2

Repository Vegetated

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>			
<b>Sheet Flow</b>							
Manning's n-value	= 0.015	0.015	0.011				
Flow length (ft)	= 300.0	80.0	0.0				
Two-year 24-hr precip. (in)	= 1.40	1.40	0.00				
Land slope (%)	= 2.00	20.00	0.00				
<b>Travel Time (min)</b>	<b>= 5.65</b>	<b>+</b>	<b>0.78</b>	<b>+</b>	<b>0.00</b>	<b>=</b>	<b>6.44</b>
<b>Shallow Concentrated Flow</b>							
Flow length (ft)	= 1500.00	0.00	0.00				
Watercourse slope (%)	= 0.70	0.00	0.00				
Surface description	= Unpaved	Paved	Paved				
Average velocity (ft/s)	=1.35	0.00	0.00				
<b>Travel Time (min)</b>	<b>= 18.52</b>	<b>+</b>	<b>0.00</b>	<b>+</b>	<b>0.00</b>	<b>=</b>	<b>18.52</b>
<b>Channel Flow</b>							
X sectional flow area (sqft)	= 0.00	0.00	0.00				
Wetted perimeter (ft)	= 0.00	0.00	0.00				
Channel slope (%)	= 0.00	0.00	0.00				
Manning's n-value	= 0.015	0.015	0.015				
Velocity (ft/s)	=0.00	0.00	0.00				
Flow length (ft)	((0))0.0	0.0	0.0				
<b>Travel Time (min)</b>	<b>= 0.00</b>	<b>+</b>	<b>0.00</b>	<b>+</b>	<b>0.00</b>	<b>=</b>	<b>0.00</b>
<b>Total Travel Time, Tc .....</b>				<b>24.96 min</b>			

**APPENDIX D**

**CONSTRUCTION QUALITY ASSURANCE**

**AND QUALITY CONTROL PLAN**



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**10-ACRE POND REMOVAL ACTION  
CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL PLAN**

**KERR-MCGEE CHEMICAL CORP. – SODA SPRINGS PLANT  
SUPERFUND SITE  
SODA SPRINGS, CARIBOU COUNTY, IDAHO**

Prepared for:

**Greenfield Environmental Multistate Trust, LLC  
Trustee of the Multistate Environmental Response Trust**

Prepared by:

**Hydrometrics, Inc.**  
3020 Bozeman Avenue  
Helena, MT 59601

May 2018

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**10-ACRE POND REMOVAL ACTION  
CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL PLAN**

**KERR-MCGEE CHEMICAL CORP. – SODA SPRINGS PLANT  
SUPERFUND SITE  
SODA SPRINGS, CARIBOU COUNTY, IDAHO**

**1.0 INTRODUCTION**

**1.1 PURPOSE**

This Construction Quality Assurance/Quality Control Plan (CQA/QCP) provides guidance in attaining and maintaining high quality in the planned Removal Action (the Project) at the Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site (the Site). Key components of the Project are removal of contaminated liquids and solids from the 10-Acre pond as well as the construction of liners and a leachate collection system for an on-Site repository. Execution of this plan will provide confidence that the Project is completed in accordance with the Contract Documents. This CQA/QCP is intended for use in conjunction with Project Plans and Specifications.

Specific Performance Standards for the Project are addressed in the 10-Acre Pond Removal Action Work Plan (RAWP) (Hydrometrics, 2018). One of the Performance Standards for the on-Site repository design requires establishment of a Construction Quality Assurance (CQA) program to ensure that the constructed cover meets or exceeds all design criteria and specifications. This CQA/QCP along with the Plans and Specifications for the on-Site repository constitutes the Construction Quality Assurance Program.

**1.2 SCOPE**

This plan has been written to include both Quality Assurance (QA) and Quality Control (QC) elements that will be applicable during construction, including methods of observations, test

procedures, and testing frequency. The overall requirements for inspection and quality assurance, as addressed in this CQA/QCP and in the Plans and Specifications, are the responsibility of the Prime Contractor. Construction QC requirements are the responsibility of the Construction Contractor as addressed in Section 2.0.

### **1.3 LIMITATIONS**

This plan focuses on the most critical elements to the success of the Project, including removal of contaminated water and solids from the 10-Acre Pond and the on-Site repository geosynthetics and drainage materials. All elements of the Project will be inspected for compliance with Specifications by the Prime Contractor. Some elements represent routine types of civil engineering construction (roads, drainage ditches, etc.) and require no special QA or QC provisions other than those described in the Project Plans and Specifications. The testing frequencies listed herein should be considered a minimum. The Prime Contractor should use their judgment to implement additional testing if they suspect a change in materials or conditions.

## **2.0 CONSTRUCTION QUALITY ASSURANCE PLAN ELEMENTS**

The following sections address CQA/QCP responsibilities and authorities, project records, and data management and control.

### **2.1 CQA/QCP RESPONSIBILITY AND AUTHORITY**

Functional roles for the CQA/QC Plan are divided among the Multistate Trust, Design Engineer, Prime Contractor, and Construction Contractor. A summary of project responsibilities and authorities relative to QA and QC is included in the following sections. Figure 2-1 presents the QA/QC Functional Organization Chart for on-Site repository construction.

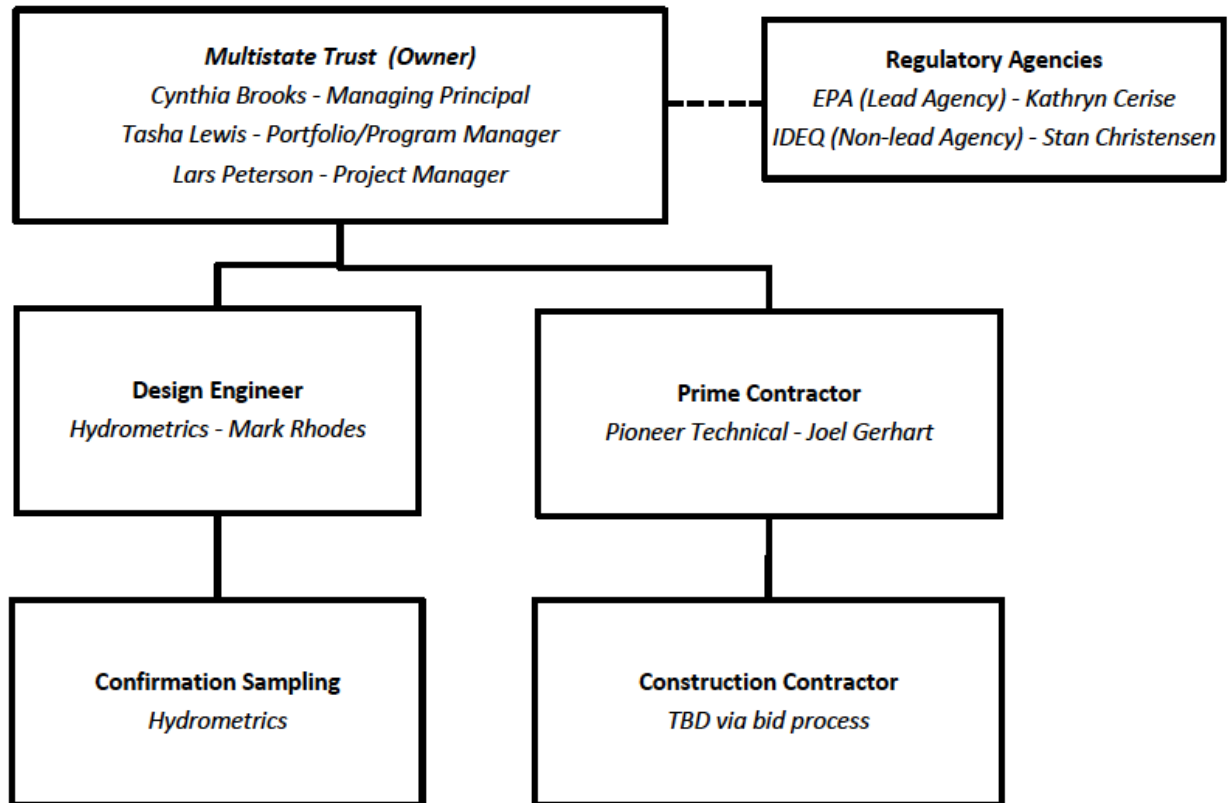
#### **2.1.1 Regulatory Agencies**

The U.S. Environmental Protection Agency (EPA) is the Lead Agency responsible for regulatory oversight at the Site along with the Idaho Department of Environmental Quality (IDEQ) as the Non-Lead Agency. The EPA and IDEQ are primarily responsible for ensuring public health and the environment is protected. The EPA has contracted with CH2M as their oversight contractor. Functional roles of the EPA during on-Site repository implementation are described in Table 2-1.

#### **2.1.2 Project Owner**

Greenfield Environmental Multistate Trust, LLC, Trustee of the Multistate Environmental Response Trust, (the Multistate Trust) is the Owner of the Site and is responsible for the control and implementation of the Site activities. Hydrometrics will provide independent QA as the Multistate Trust's representative during the Project. Functional roles of the Multistate Trust are further defined in Table 2-1.

**FIGURE 2-1. CONSTRUCTION QUALITY ASSURANCE  
FUNCTIONAL ORGANIZATION**



**TABLE 2-1. QUALITY ASSURANCE AND QUALITY CONTROL ROLES BY FUNCTIONAL POSITION**

<b>Regulatory Agency (EPA)</b>	<b>Multistate Trust</b>	<b>Design Engineer (Hydrometrics)</b>	<b>Prime Contractor (Pioneer)</b>	<b>Construction Contractor</b>
<ul style="list-style-type: none"> <li>• Reviews and approves 10-Acre Pond Removal Action Work Plan.</li> <li>• Attends or participates in progress meetings, as necessary.</li> <li>• Coordinates government agency interaction, as necessary.</li> <li>• Ensures protection of public health and environment.</li> </ul>	<ul style="list-style-type: none"> <li>• Controls and effects implementation of the 10-Acre Pond Time Critical Removal Action</li> <li>• Assigns work to the Design Engineer and Prime Contractor</li> <li>• Responsible for Site Environmental Actions.</li> <li>• Obtains approvals needed to accomplish project completion.</li> <li>• Verifies completion of work and approves project closeout.</li> <li>• Ensures protection of public health and environment</li> </ul>	<ul style="list-style-type: none"> <li>• Prepares the 10-Acre Pond Removal Action Work Plan, including all construction plans and specifications, and other design documents.</li> <li>• Identifies approvals needed to accomplish project completion.</li> <li>• Provides project engineering and designs.</li> <li>• Performs any necessary design changes during construction to include updates to plans and specifications and construction changes.</li> </ul>	<ul style="list-style-type: none"> <li>• Assesses compliance with construction permits and approvals.</li> <li>• Maintains project records.</li> <li>• Implements portions of CQA/QCP including testing and construction inspection.</li> <li>• Performs independent, on-Site inspections, may include implementation or oversight of performance and certification testing.</li> <li>• Implements CQA/QCP including testing, reporting, and construction inspection.</li> <li>• Performs on-Site inspections, including oversight of performance and certification testing.</li> </ul>	<ul style="list-style-type: none"> <li>• Implements CQA/QCP for specific construction activities.</li> <li>• Provides required submittals including progress schedules, reports, and QC documentation.</li> <li>• Submits lists of equipment, material, and proposed methods of work to engineering inspectors.</li> <li>• Submits manufacturers' or suppliers' certification that materials meet specifications</li> </ul>



### **2.1.3 Project Engineer**

Hydrometrics is the Design Engineer for the Project. During project design, the Design Engineer is primarily responsible for providing development of designs, plans, and specifications which meet project requirements. Functional roles of the Design Engineer during design are addressed in Table 2-1.

### **2.1.4 Prime Contractor**

Pioneer Technical Services (Pioneer) is the Prime Contractor for the Project. The overall responsibility of the Prime Contractor is to execute the activities specified under the CQA/QCP and to oversee the routine inspection of the Project and assure that quality standards specified by the design documents are met. The Prime Contractor will implement and assure adherence to the CQA/QCP. The Prime Contractor will provide a Project Manager to maintain project records as defined in Section 2.3. Functional roles of the Prime Contractor are addressed in Table 2-1.

### **2.1.5 Construction Contractor**

Pioneer is the Prime Contractor for the project and will solicit bids and contract a Construction Contractor to perform the work. The Prime Contractor will be responsible for project administration and managing the Construction Contractor. During construction, the Construction Contractor will be responsible for construction QC. The Construction Contractor will designate a QC representative(s) responsible for ensuring adherence to the CQA/QCP. The Construction Contractor will provide required submittals and documentation to the Prime Contractor. Functional roles of the Construction Contractor during design are addressed in Table 2-1.

## **2.2 PROJECT RECORDS**

Project records will be maintained by the Prime Contractor's Project Manager. Submittals by various subcontractors and their vendors will include pertinent shop drawings, data sheets, material certifications, mix designs, permits, test results, and other pertinent or required submittals. The Project Manager will prepare various reports that describe the construction activities and provide documentation that the construction conforms to approved Plans and

Specifications. The specific reports, their content, distribution and distribution schedule will be developed for each specific construction activity. At a minimum, the following reports will be part of the project records:

1. Daily Inspector Report; and
2. Inspection Testing Forms.

Examples of these project reports are included in Attachment A.

## **2.3 DATA MANAGEMENT AND DOCUMENT CONTROL**

All information relevant to construction activities will be categorized as either (a) data, or (b) construction project records. Data are results from the measurement of some parameter of media and can include sampling and analytical results, and other tests or measurement (e.g., survey information). Construction project records consist of all documentation pertinent to project construction activities.

The QA methods and procedures outlined in this CQA/QCP will be used to verify and document that the Project is completed in accordance with plans and specifications and codes, standards and practices referenced therein.

## **2.4 MEETINGS**

To effectively implement this plan, several meetings will be held to promote communication. The meetings are described below.

### **2.4.1 Pre-Bid Meeting**

The meeting will be held prior to bid opening and will allow interested construction contractors a chance to discuss questions with the Multistate Trust and Design Engineer and to visit the Site.

### **2.4.2 Pre-Construction Meeting**

The meeting will be held before construction commences. The Construction Contractor, Prime Contractor, Design Engineer and Multistate Trust will attend this meeting. At this

meeting, the Design Engineer's oversight plans will be discussed as well as the CQA/QCP and any specific CQA/QCP addendum.

### **2.4.3 Progress Meetings**

These meetings will be held during construction and their frequency may vary with the amount of construction activity ongoing. While discussion at these meetings may include a wide variety of topics, it should also include any problems encountered or anticipated that are related to CQA. The Construction Contractor, Prime Contractor, Design Engineer and Multistate Trust will attend progress meetings to monitor overall project progress and issues, particularly those related to QA and QC. EPA and IDEQ will be notified of progress meetings, provided an agenda and handouts, and may participate via phone or in person.

## **2.5 REPORTING**

QA/QC issues will be recorded and reported to interested parties in a number of ways. The Prime Contractor will prepare general daily, weekly, and monthly reports documenting construction progress and issues. QA/QC test failures or non-conformance shall be noted on daily logs. Additionally, each test failure or non-conformance will be further reported on a special report documenting the issue and its resolution. Sample QA/QC test forms are included in Attachment A.

Daily reports and QA/QC issue reports will be distributed to the Design Engineer and Multistate Trust. Distribution methods may include hand delivery, fax, mail, e-mail, website, or other methods.

### **3.0 EARTHWORK**

This section describes QA and QC measures for all earthwork to be performed.

#### **3.1 QUALITY CONTROL MEASURES**

The Construction Contractor shall perform QC measures on excavated on-Site soils, imported borrow materials, and other miscellaneous earthen materials.

QC measures for on-Site soils to be used for cover soil and subsoil shall include visual inspection. All organic material including roots, sticks, leaves, brush trash, and any other debris shall be removed before stockpiling or using excavated material.

QC measures for imported borrow materials to be used for drain aggregate shall include visual inspection, gradation, and liquid and plasticity limits (where applicable). Table 3-1 lists the specific tests, frequency of testing and acceptance criteria. For those QC tests whose frequency is listed as continuous in Table 3-1, QA tests will be performed at least once per shift for a minimum of 15 minutes.

#### **3.2 QUALITY ASSURANCE MEASURES**

The Prime Contractor's inspectors will perform QA testing to corroborate QC testing. In general, QA testing will use the same methods, standards and rejection criteria as QC testing. Visual test methods will be performed continuously by inspectors. QC placement tests (i.e., in-place density) will be observed by the inspectors for QA. Additional QA placement tests may be performed at the Prime Contractor's discretion.

**TABLE 3-1. QC TESTS FOR SELECTED EARTHEN MATERIALS**

<b>Material</b>	<b>Test Description<sup>(1)</sup></b>	<b>Test Method</b>	<b>Test Frequency</b>	<b>Standard</b>	<b>Test Rejection Criteria<sup>(4)</sup></b>
Drain Aggregate	Deleterious Materials	Visual	Continuous	--	All foreign material and undersized or oversized particles to be removed.
	Gradation	ASTM D-6913	1 per 5,000 cy <sup>(2)</sup>	Special provisions	No deviation from standard.
	Liquid and Plastic Limits and Plasticity Index	ASTM D-4318	1 per 5,000 cy <sup>(2, 3)</sup>	LL <40 PI <6	No deviation from standard.
General Waste Materials	Compaction	Visual; Proof roll	Continuous	8 passes (4 cycles) with proper compaction equipment	No deviation from standard.
	Lift Thickness	Visual Measurement	Continuous	2-foot lifts	No deviation from standard.
	Gradation	Visual Measurement	Continuous	At least one dimension less than 2 feet	Long oversized debris will be laid flat and void space minimized. Pipes and structures with large voids must be crushed or broken to minimize voids.
General Waste Materials	Moisture	Visual	Continuous	Special provisions	Pond solids with free water or that cannot be contained in a truck bed must be dried prior to hauling to the on-Site repository. Soil will be dried and/or mixed if necessary for compaction.
Geosynthetic Waste Materials	Size	Visual Measurement	Continuous	Special provisions	Geosynthetics must be shredded or otherwise sized to be compacted within the 2 foot waste lifts with minimal voids.
Bottom Liner Subgrade	Standard Proctor Density	ASTM D-698	1 test minimum	N/A	N/A
	In-Place Density	ASTM D-6938	3 per acre	90% of maximum dry density	No deviation from Standard. Rework and retest failed areas.

**TABLE 3-1. QC TESTS FOR SELECTED EARTHEN MATERIALS (continued)**

<b>Material</b>	<b>Test Description</b>	<b>Test Method</b>	<b>Test Frequency</b>	<b>Standard</b>	<b>Test Rejection Criteria<sup>(4)</sup></b>
Calcine Cushion Material	Deleterious Materials	Visual	Continuous	--	All foreign material and undersized or oversized particles to be removed.
	Compaction	Visual	Continuous	Firm, unyielding surface meeting GCL subgrade requirements	No deviation from standard.
Cover Soil	Soil Quality	Visual	Continuous	No oversized particles, roots, sticks, leaves, brush, trash or other debris	Remove all material not meeting standard
Anchor Trench	Standard Proctor Density	ASTM D-698	1 test minimum	N/A	N/A
	In-Place Density	ASTM D-6938	1 per 750 linear feet per lift	92% of maximum dry density	No deviation from Standard. Rework and retest failed areas.

**Notes:**

- (1) Inspection shall be by the Construction Contractor's QC representatives, equipment operators, laborers, or other personnel.
- (2) Frequency shown is for each type of material. If there is a change in the material or supplier, the same frequency shall apply to the new material.
- (3) Liquid and plastic limit testing not applicable to those materials with less than 1% (by weight) of material passing the No. 40 sieve.
- (4) Unless otherwise specified, deviations shall be corrected by reworking material until the standard is met.

#### **4.0 HDPE FLEXIBLE MEMBRANE LINERS**

Flexible Membrane Liners (FMLs) provide the primary barrier layer for the on-Site repository bottom liner and cover liner. All FML specified for this project is 60 mil double-sided textured High Density Polyethylene (HDPE). The term geomembrane is used interchangeably with FML in the project documents.

Before shipping any FMLs to the Site, the Construction Contractor shall submit the manufacturer's QA testing results to the Prime Contractor. At a minimum, the manufacturer's QA tests shall consist of the tests list in Table 4-1. Test standards are minimum average roll values (MARV). The manufacturer's QA tests will be conducted on the particular lot(s) to be used for this Project.

On delivery of FMLs to the Project Site, the Prime Contractor shall collect additional samples for confirmation testing. The Prime Contractor shall select one roll of each FML lot and shall remove an appropriate length for confirmation testing. Confirmation testing shall duplicate the requirements specified in Table 4-1 at a frequency of 1 test per lot.

The Construction Contractor shall implement QC measures during FML installation. QC measures shall include visual inspection of the receiving surface, anchor trenches, panel placement, and seams as well as destructive and non-destructive testing of seams. Destructive testing will be conducted on seam samples that are cut from a completed seam. The samples shall be approximately 36 inches by 12 inches. From the sample, the Construction Contractor shall deliver to the Engineer two 12-inch by 12-inch pieces for laboratory testing and archival storage. The remainder will be used by the Construction Contractor for field testing. Table 4-2 lists the QC tests, their frequency, and rejection criteria.

The Prime Contractor shall implement QA procedures during FML installation. In general, Prime Contractor will perform the same tests as indicated in Table 4-2 at the same frequency.

**TABLE 4-1. MANUFACTURER'S QA TESTS FOR FML**

Property	Test Method	Test Frequency	Test Standard	Rejection Criteria
Thickness (mils)	ASTM D-5994	Every roll	57	Material must meet all standards <u>before</u> delivery to site
Minimum Average Lowest Individual Reading			54	
Asperity Height (mils)	ASTM D-7466	Every 2 rolls	16	
Specific Gravity	ASTM D-1505	200,000 lb	≥0.94	
Tear Strength (pounds)	ASTM D-1004	50,000 lb	42	
Tensile Strength - each direction	ASTM D-6693 Type IV	20,000 lb	126	
1. Yield Stress (lb/in)			90	
2. Break Stress (lb/in)			12	
3. Yield Elongation (%)			100	
4. Break Elongation (%)				
Puncture Resistance (lb)	ASTM D-4833	50,000 lb	90	
Stress Crack Resistance <sup>(1)</sup> (hours)	ASTM D-5397	200,000 lb	500	
Oxidative Induction Time – Standard OIT (min ave) <sup>(1,2)</sup>	ASTM D-3895	200,000 lb	100	
Carbon Black Content <sup>(1)</sup>	ASTM D-4218	20,000 lb	2 – 3%	
Carbon Black Dispersion <sup>(1)</sup>	ASTM D-5596	50,000 lb		

## Notes:

- (1) Engineer confirmation testing is not required for these properties. Confirmation tests may be completed at Engineer's discretion.
- (2) Manufacturer may substitute High Pressure OIT testing (ASTM D-5885) for Standard OIT. Test standard for High Pressure OIT is 400 min.



**TABLE 4-2. QUALITY CONTROL CRITERIA FOR FML**

Parameter	Test Method	Frequency	Standard	Test Rejection Criteria
Surface Conditions	Visual Inspection	100%	No holes, ridges, voids, rocks, roots, ruts or other non-conformities	Reject and replace all surfaces with any of the items at left
Anchor Trenches	Visual/Tape Measure	100%	See dimensions on project plans	Reject and repair all non-conforming trenches
FML Placement	Visual	100%		Reject and replace non-conforming panels
Seaming	Visual	100%		
Seam Shear and Peel <sup>(1)</sup>	ASTM D-4437	1 per 500 to 1,000 feet of seam (see Special Provisions)	Shear strength: 120 lb/in – 60 mil Peel strength: 91 lb/in <sup>(2)</sup> – 60 mil 78 lb/in <sup>(3)</sup> – 60 mil	Reject and replace non-conforming seams
Trial Seam	ASTM D-4437	1) Beginning of each shift of seaming and every four hours thereafter 2) At any change in seam operator, equipment or weather	See Seam Shear & Peel values above	Repeat trial seaming until standard is met
Spark Test Vacuum Box or Internal Pressure	ASTM D-7240 ASTM D-4437 or ASTM D-5820	100% <sup>(4)</sup>	No spark No bubbles emerging from seams  Loss of pressure ≤4 psi in 5 minutes	Identify, repair, and replace leaking seams

## Notes:

- (1) Four out of five tests must meet standard. All tests must exceed 80% of standard.
- (2) Criterion for hot wedge seams.
- (3) Criterion for extrusion welds.
- (4) Hot wedge seams shall be tested by internal pressure. Extrusion welds shall be tested by vacuum box. Spark testing shall only be used where internal pressure and vacuum testing is not possible (e.g., liner penetrations). Prime Contractor shall observe tests for QA.

## **5.0 GEOCOMPOSITES**

Geocomposites are used in the on-Site repository leachate collection system and cover liner system. The Construction Contractor will obtain the manufacturer's certification that the material conforms to the MARV Project Specifications shown in Table 5-1 and provide copies to the Prime Contractor. The Prime Contractor will be present during the delivery and unloading of geocomposites. Confirmation testing requirements are listed in Table 5-2. These will be performed by the manufacturer or Construction Contractor on the material lots used for this Project, and results will be provided to Prime Contractor no later than at delivery of the geocomposite.

The Prime Contractor and Design Engineer will be present during installation of the geocomposite and will visually confirm that overlap and panel fasteners conform to Project Specifications. Copies of manufacturer's certifications and the results of any testing or inspection conducted by the Prime Contractor will be provided to the Design Engineer.

Quality control measures to be implemented by the Construction Contractor shall include storage, handling, and complete visual inspection of overlaps and seaming procedures. QA measures implemented by the Design Engineer shall also include complete visual inspection of overlap and seaming procedures.

**TABLE 5-1. MANUFACTURER'S QA TESTS FOR GEOCOMPOSITE**

Property	Test Method	Test Frequency	Test Standard	Rejection Criteria
<b>Geonet</b>				Manufacturer must certify all standards <u>before</u> delivery to site
Core Thickness (mil)	ASTM D-5199	50,000 ft <sup>2</sup>	250	
Transmissivity (gal/min/ft)	ASTM D-4716	50,000 ft <sup>2</sup>	14	
Specific Gravity	ASTM D-1505	50,000 ft <sup>2</sup>	0.94	
Tensile Strength (lb/in)	ASTM D-7179	50,000 ft <sup>2</sup>	50	
<b>Geotextile</b>				
Mass per Unit Area (oz/yd <sup>2</sup> )	ASTM D-5261	90,000 ft <sup>2</sup>	8	
Grab Tensile Strength (lb)	ASTM D-4632	90,000 ft <sup>2</sup>	220	
CBR Puncture Strength (lb)	ASTM D-6241	600,000 ft <sup>2</sup>	500	
Permittivity (sec <sup>-1</sup> )	ASTM D-4491	600,000 ft <sup>2</sup>	1.2	
Water Flow (gpm/ft <sup>2</sup> )	ASTM D-4491	600,000 ft <sup>2</sup>	90	
Apparent Opening Size (U.S. sieve, max)	ASTM D-4751	600,000 ft <sup>2</sup>	80	
<b>Geocomposite</b>				
Ply Adhesion (lb/in)	ASTM D-7005	50,000 ft <sup>2</sup>	1.0	
Transmissivity (gpm/ft (m <sup>2</sup> /sec))	ASTM D-4716	600,000 ft <sup>2</sup>	2.4 (5x10 <sup>-4</sup> )	

**TABLE 5-2. CONFIRMATION SAMPLING FOR GEOCOMPOSITES**

PARAMETER	TEST	MINIMUM TEST FREQUENCY	REJECTION CRITERIA
Thickness	ASTM D-5199	1 per lot <sup>(1)</sup>	Reject any lot sampling unit or lots that do not meet ASTM-D-4759, Section 5.
Geocomposite Transmissivity	ASTM D-4716 ≥22 psi normal pressure and 0.1 ft/ft hydraulic gradient	1 per lot <sup>(1)</sup>	Reject any lot sampling unit or lots that do not meet ASTM-D-4759, Section 5.

Notes:

- (1) A lot is the smaller of 100,000 square feet or one production run.

## **6.0 GEOSYNTHETIC CLAY LINER**

Geosynthetic Clay Liners (GCLs) are used as the secondary barrier layer component for the on-Site repository. The Construction Contractor or manufacturer shall provide acceptance testing of the GCL according to Table 6-1. Test results shall be provided to the Prime Contractor and Design Engineer before any GCL is shipped to the Project.

During GCL placement, the Construction Contractor shall perform QC tests according to Table 6-2. The Prime Contractor shall perform QA tests of the same type and at the same frequency as those tests shown in Table 6-2.

If any holes result in the GCL for any reason, the Construction Contractor shall repair the hole by placing a patch of GCL over the affected area. The patch will have a minimum of 12 inches of overlap on all sides from the affected area. Granular bentonite shall be uniformly scattered over the entire patch area at the same rate as used in panel overlaps. The Construction Contractor and Prime Contractor shall visually inspect all hole repairs.

**TABLE 6-1. ACCEPTANCE TESTING FOR GCL**

Parameter	Test Method	Frequency	Test Standard	Rejection Criteria
Bentonite Mass per Unit Area	ASTM D-5993	1 per lot <sup>(1)</sup>	0.75 lb/ft <sup>2</sup> MIN	Materials must pass all acceptance testing before delivery to site
Bentonite Swell Index (2 grams)	ASTM D-5890		24 ml MIN	
Bentonite Fluid Loss, ml	ASTM D-5891		18 ml MAX	
Bentonite moisture content	ASTM D-5993		35% MAX <sup>(2)</sup>	
Geotextile Density	ASTM D-5261		5.9 oz/yd <sup>2</sup> MIN	
Hydraulic Conductivity	ASTM D-5887		5 x 10 <sup>-9</sup> cm/sec MAX	
Tensile Strength	ASTM D-6768		45 lb/in MIN	
Peel Strength	ASTM D-6496		3.5 lb/in MIN	
Shear Strength	ASTM D-6243	1,000,000 ft <sup>2</sup>	500 psf MIN <sup>(3)</sup>	

## Notes:

- (1) All material used on the project must be from the sampled lot(s).
- (2) Bentonite moisture content measured after incorporation into GCL.
- (3) Hydrated internal shear strength measured at 200 psf normal stress.

**TABLE 6-2. QC MEASURES FOR GCL**

Parameter	Test Method	Testing Frequency	Test Standard	Rejection Criteria
Minimum Overlap	Visual/Measuring Tape	100%	6 inches longitudinal 24 inches end of roll	Manually move panels to meet specifications
Subgrade Smoothness	Visual		No bridging of GCL $\geq$ 1 inch	Manually repair area
GCL Rips, Tears, Holes	Visual		No irregularities	Patch all irregularities
Granular Bentonite in Overlaps	Visual		1/4 lb per foot or Internal longitudinal bentonite seam	Add granular bentonite to meet specification
Freezing/Unrestrained Hydration	Visual		Visibly uneven	Remove and replace affected GCL
Hole Repair	Visual		12 inches of overlap all around with granular bentonite	Remove and replace patch

## 7.0 SEPARATION GEOTEXTILE

A non-woven geotextile will be used as a separation layer between the leachate collection and removal system (LCRS) drain gravel and the overlying waste material. The Construction Contractor will obtain the manufacturer's certification that the material conforms to the MARV Project Specifications shown in Table 7-1 and provide copies to the Prime Contractor and Design Engineer. The Prime Contractor and Design Engineer will be present during the delivery and unloading of separation geotextile. Copies of manufacturer's certifications and the results of any testing or inspection conducted by the Prime Contractor will be provided to the Design Engineer.

Quality control measures to be implemented by the Prime Contractor shall include storage, handling, and complete visual inspection of geotextile placing and overlap procedures. QA measures implemented by the Design Engineer shall also include complete visual inspection of geotextile placing and overlap procedures.

**TABLE 7-1. MANUFACTURER'S QA TESTS FOR GEOCOMPOSITE**

Property	Test Method	Test Frequency	Test Standard	Rejection Criteria
Mass per Unit Area (oz/yd <sup>2</sup> )	ASTM D-5261	90,000 ft <sup>2</sup>	5.9	Manufacturer must certify all standards <u>before</u> delivery to site
Grab Strength (lb)	ASTM D-4632	90,000 ft <sup>2</sup>	158	
Trapezoid Tear Strength (lb)	ASTM D-4533	90,000 ft <sup>2</sup>	55	
Apparent Opening Size (U.S. sieve, max)	ASTM D-4751	600,000 ft <sup>2</sup>	70	
Permittivity (sec <sup>-1</sup> )	ASTM D-4491		0.02	

## 8.0 LEACHATE COLLECTION SUMP AND PIPING

Perforated piping and smooth solid piping are used in the repository leachate collection systems. QA/QC measures for piping shall include obtaining manufacturer's certifications that the materials meet the Project Specifications, survey verification of pipe grades, verification that pipe joints were constructed according to the specifications, and verification that the pipe is not damaged during backfilling.

During construction of the leachate collection system, the Construction Contractor shall perform QC tests according to Table 8-1. The Prime Contractor shall perform QA tests of the same type and at the same frequency as those tests shown in Table 8-1.

**TABLE 8-1. QA/QC MEASURES FOR LEACHATE  
COLLECTION SUMP AND PIPING**

Parameter	Test Method	Testing Frequency	Test Standard	Rejection Criteria
Pipe Grade	Visual/Level	100%		Manually move piping to meet grade specifications
Pipe Joints	Visual			Repair joints to meet joint specifications.
Backfilling over Pipe	Visual		No damage	Remove and replace all piping damaged during backfilling.



## 9.0 REFERENCES

ASTM D-698, "Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort."

ASTM D-1004 "Test Method for Initial Tear Resistance of Plastic Film and Sheeting."

ASTM D-1505, "Standard Test Method for Density of Plastic by the Density-Gradient Technique."

ASTM D-3895, "Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry."

ASTM D-4218, "Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds By the Muffle-Furnace Technique."

ASTM D-4318, "Liquid Limit, Plastic Limit and Plasticity Index of Soils."

ASTM D-4437, "Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes."

ASTM D-4491, "Standard Test Methods for Water Permeability of Geotextiles by Permittivity."

ASTM D-4533, "Standard Test Method for Trapezoid Tearing Strength of Geotextiles."

ASTM D-4632, "Standard Test Method for Grab Breaking Load and Elongation of Geotextiles."

ASTM D-4716, "Standard Test Method for Constant Head Hydraulic Transmissivity (In-plane Flow) of Geotextiles and Geotextile Related Product."

ASTM D-4751, "Standard Test Methods for Determining Apparent Opening Size of a Geotextile."

ASTM D-4759, "Standard Practice for Determining the Specification Conformance of Geosynthetics."

ASTM D-4833, "Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products."

ASTM D-5199, "Measuring Nominal Thickness of Geotextiles and Geomembranes."

ASTM D-5261, "Standard Test Method for Measuring Mass per Unit Area of Geotextiles."

- ASTM D-5397, “Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.”
- ASTM D-5596, “Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.”
- ASTM D-5820, “Standard Practice for Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.”
- ASTM D-5885, “Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry.”
- ASTM D-5887,” Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter.”
- ASTM D-5890, “Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.”
- ASTM D-5891, “Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.”
- ASTM D-5993, “Standard Test Method for Measuring Mass Per Unit of Geosynthetic Clay Liners.”
- ASTM D-5994, “Standard Test Method for Measuring Core Thickness of Textured Geomembrane.”
- ASTM D-6241, “Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.”
- ASTM D-6243, “Standard Test Method for Determining the Internal and Interface Shear Strength of Geosynthetic Clay Liner by the Direct Shear Method.”
- ASTM D-6496, “Standard Test Method for Determining Average Bonding Peel Strength Between Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners.”
- ASTM D-6693, “Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.”
- ASTM D-6768, “Standard Test Method for Tensile Strength of Geosynthetic Clay Liners.”
- ASTM D-6913, “Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.”
- ASTM D-6938, “Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).”

ASTM D-7005, “Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites.”

ASTM D-7179, “Standard Test Method for Determining Geonet Breaking Force.”

ASTM D-7240, “Standard Practice for Leak Location using Geomembranes with an Insulating Layer in Intimate Contact with a Conductive Layer via Electrical Capacitance Technique (Conductive Geomembrane Spark Test).”

ASTM D-7466, “Standard Test Method for Measuring Asperity Height of Textured Geomembranes.”

Hydrometrics, 2018. 2018 10-Acre Pond Removal Action Work Plan, Kerr-McGee Superfund Site, Soda Springs, Caribou County, ID, March 2018.

## **ATTACHMENT A**

### **FIELD FORMS**

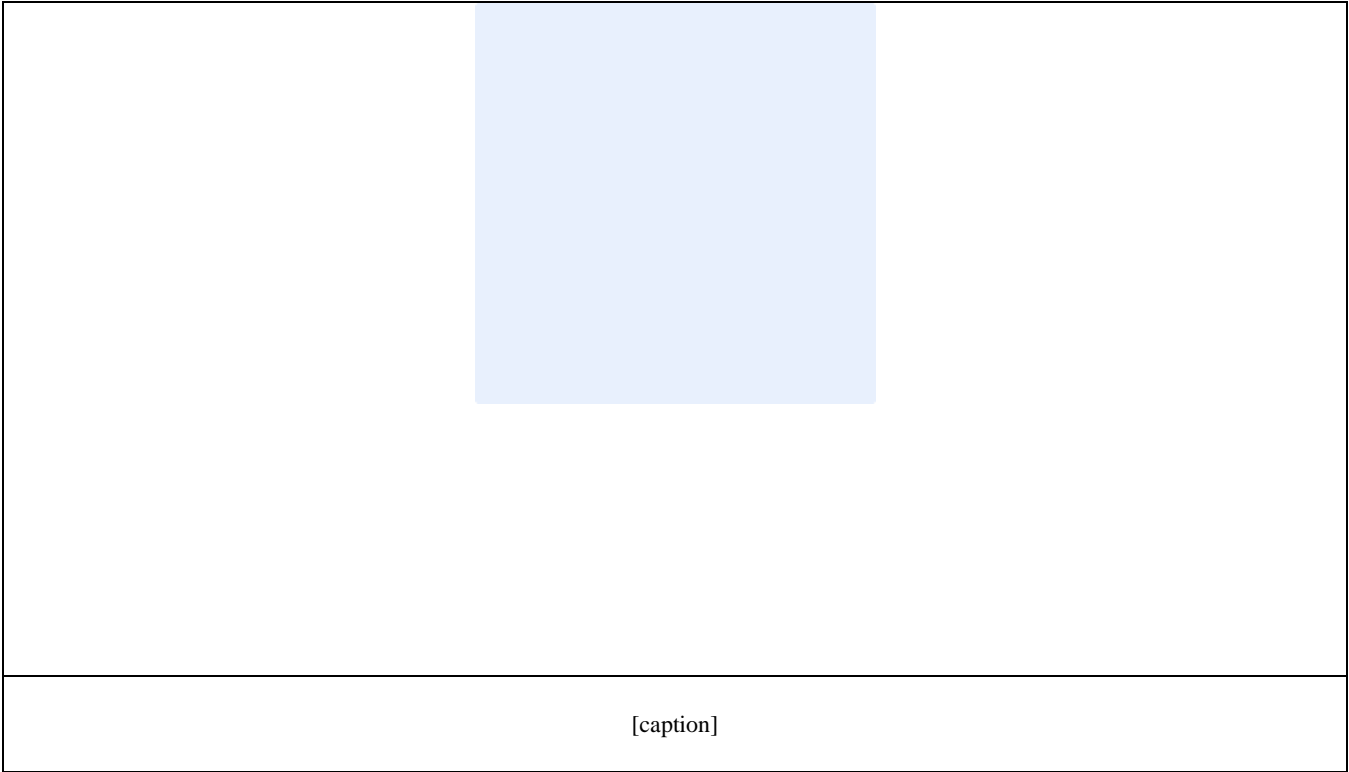
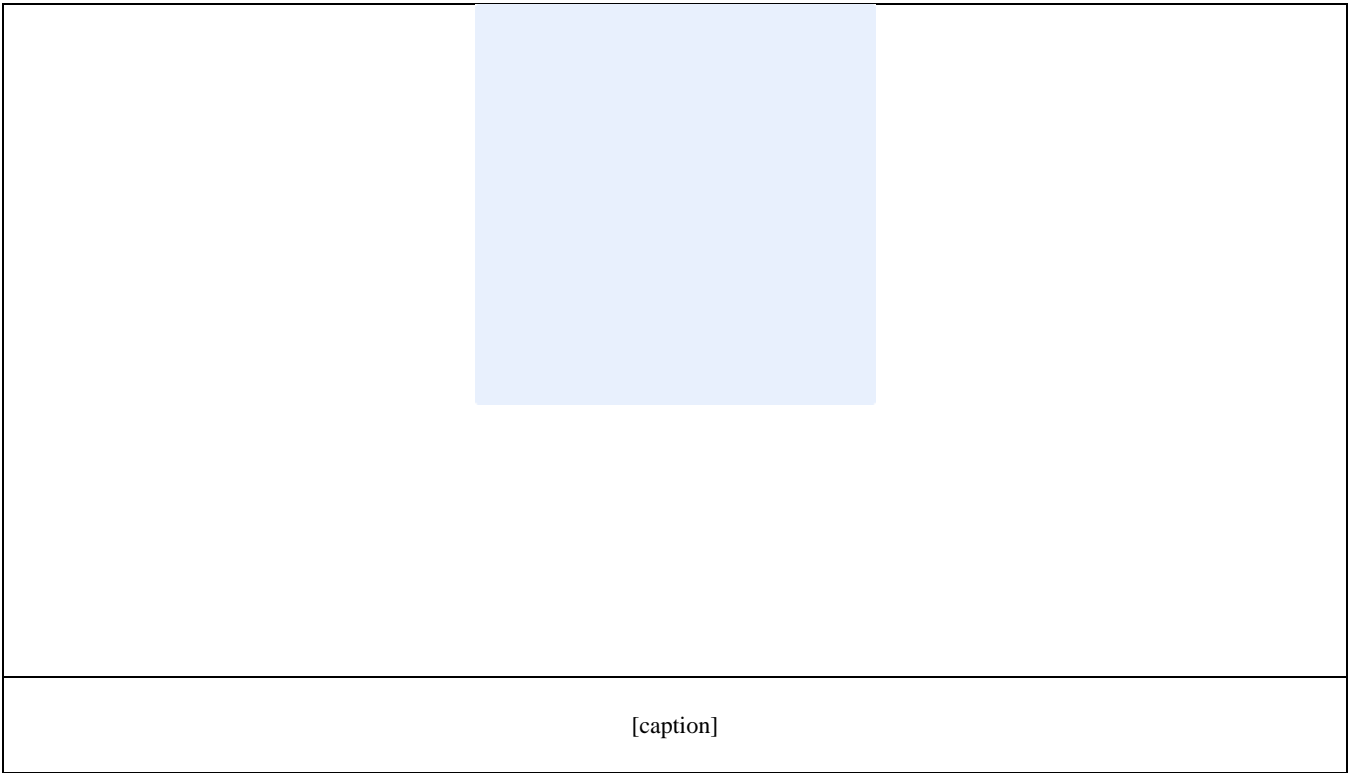


TO: Click here to enter text.				DATE 3/5/18	
PROJECT: Click here to enter text.				CONTRACT NUMBER	
CONTRACTOR: Click here to enter text.				WORK DAY	WEATHER DAY
HAS ANYTHING DEVELOPED ON THE WORK THAT MIGHT LEAD TO A CHANGE ORDER OR FINDING OF FACT? <div style="text-align: center;"><input type="checkbox"/> NO      <input type="checkbox"/> YES</div>				WEATHER DESCRIPTION	
HEALTH AND SAFETY Was a Job Safety Meeting held this date? <div style="text-align: center;"><input type="checkbox"/> NO      <input type="checkbox"/> YES</div>				TEMPERATURE (F)	
				MINIMUM	MAXIMUM
NUMBER OF CONTRACTOR'S EMPLOYEES				24 HOUR PRECIPITATION	
SUPERVISORY	OPERATORS	LABORERS	TOTAL	INCHES	
SUBCONTRACTORS ON SITE					
COMPANY NAME				TOTAL EMPLOYEES	
1. 2. 3.				1. 2. 3.	
LIST THE MAJOR ITEMS OF EQUIPMENT					
	No. OF UNITS	EQUIPMENT DESCRIPTION	IN USE	STANDBY	REPAIR
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
NOTE -					
VISITORS					
	TIME	NAME	REPRESENTING	PURPOSE	
1.					
2.					
3.					
4.					
5.					
6.					



<b>WORK PERFORMED TODAY</b>		
	<b>BID ITEM NUMBER</b>	<b>DESCRIPTION</b>
1.		
2.		
3.		
4.		
5.		
6.		
7.		
REASON FOR NO WORK –		
INFORMATION ON PROGRESS OF WORK – (Causes for delays, extent of delays, etc.)		
<b>MATERIALS DELIVERED TO SITE</b>		
	<b>QTY.</b>	<b>DESCRIPTION</b>
1.		
2.		
3.		
4.		
NOTE -		
<b>INSPECTIONS AND TESTS (Include comment pertaining to contractors activities)</b>		
	<b>DESCRIPTION</b>	<b>RESULT</b>
1.		
2.		
3.		
4.		
5.		
6.		
7.		
<b>SAMPLES COLLECTED</b>		
	<b>SAMPLE ID</b>	<b>DESCRIPTION</b>
1.		
2.		
3.		
4.		
5.		
<b>VERBAL REQUESTS TO CONTRACTOR</b>		
	<b>NAMES</b>	<b>REQUEST</b>
1.		
2.		
3.		
4.		
NOTES -		







PROJECT NAME \_\_\_\_\_ DATES \_\_\_\_\_  
 CQA ENGINEER \_\_\_\_\_ SHEET \_\_\_\_\_ of \_\_\_\_\_

[illegible]

**DATE:** \_\_\_\_\_

SHEET \_\_\_\_\_ OF \_\_\_\_\_

**CONDITION ON ARRIVAL** \_\_\_\_\_

UNLOADING METHOD \_\_\_\_\_

NUMBER OF ROLLS \_\_\_\_\_

**STORAGE LOCATION** \_\_\_\_\_

[illegible]

## CERTIFICATE OF SUBGRADE ACCEPTANCE

---

PROJECT NAME: \_\_\_\_\_ DATE: \_\_\_\_\_  
INSTALLATION SUBCONTRACTOR: \_\_\_\_\_  
CQA ENGINEER: \_\_\_\_\_  
MATERIAL DESCRIPTION: \_\_\_\_\_

---

The following areas are approved for placement:

---

---

---

---

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---

The installer shall be responsible for maintaining the approved areas in accordance with the Contract Documents from this date to the completion of installation.

### INSTALLER'S REPRESENTATIVE

_____ Name	_____ Signature	_____ Date
---------------	--------------------	---------------

### CQA ENGINEER

_____ Name	_____ Signature	_____ Date
---------------	--------------------	---------------

---

Notes:

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---

---

PROJECT NAME \_\_\_\_\_ DATES \_\_\_\_\_  
 CQA ENGINEER \_\_\_\_\_ SHEET \_\_\_\_\_ of \_\_\_\_\_

[illegible]

\*BUTT SEAMS ONLY

PROJECT NAME: \_\_\_\_\_ DATE: \_\_\_\_\_  
 PROJECT #: \_\_\_\_\_  
 E OF RESPONSIBLE PERSON: \_\_\_\_\_  
 MATERIAL DESCRIPTION: \_\_\_\_\_ SHEET \_\_\_\_\_ OF \_\_\_\_\_

[illegible]

[illegible]

DATE:

**PROJECT #:** \_\_\_\_\_

NAME OF RESPONSIBLE PERSON: \_\_\_\_\_

**MATERIAL DESCRIPTION:** \_\_\_\_\_

**SHEET**                      **OF**

[illegible]

DATE: \_\_\_\_\_

---

---

SHEET \_\_\_\_\_ OF \_\_\_\_\_

[illegible]



Project Name \_\_\_\_\_ Date \_\_\_\_\_  
 Material Description \_\_\_\_\_ CQA Engineer \_\_\_\_\_ Sheet \_\_\_\_\_ of \_\_\_\_\_

[illegible]

Project Name \_\_\_\_\_ Date \_\_\_\_\_  
 Material Description \_\_\_\_\_ CQA Engineer \_\_\_\_\_ Sheet \_\_\_\_\_ of \_\_\_\_\_

[illegible]

## **APPENDIX E**

### **CONSTRUCTION OPERATION AND MAINTENANCE PLAN**

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**CONSTRUCTION OPERATION AND MAINTENANCE PLAN  
KERR-MCGEE CHEMICAL CORP. – SODA SPRINGS PLANT  
SUPERFUND SITE  
SODA SPRINGS, CARIBOU COUNTY, IDAHO**

Prepared for:

**Greenfield Environmental Multistate Trust, LLC  
Trustee of the Multistate Environmental Response Trust**

Prepared by:

**Hydrometrics, Inc.**  
3020 Bozeman Avenue  
Helena, MT 59601

May 2018

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**CONSTRUCTION OPERATION AND MAINTENANCE PLAN  
KERR-MCGEE CHEMICAL CORP. – SODA SPRINGS PLANT  
SUPERFUND SITE  
SODA SPRINGS, CARIBOU COUNTY, IDAHO**

**1.0 GENERAL INFORMATION**

This Operation and Maintenance (O&M) Plan addresses care, operation, waste hauling, monitoring, and maintenance of the on-Site repository during construction and is included as Appendix E of the 10-Acre Pond Removal Action Work Plan. Once the removal action has been completed, the existing O&M Plan for the Site will be updated to include long-term O&M requirements related to the removed 10-Acre Pond and new on-Site repository. Ongoing O&M activities will be modified to include any necessary work related to this project, the results of which will continue to be provided to EPA, the Lead Agency and IDEQ, the Non-Lead Agency, in regular monthly progress reports for the Site. The on-Site repository is designed in accordance with the substantive requirements of the Resource Conservation and Recovery Act (RCRA), Subtitle D regulations and guidelines.

**1.1 PURPOSE**

The purpose of this O&M Plan is to set forth the requirements for operation and maintenance of the on-Site repository and 10-Acre Pond area during construction. This O&M Plan establishes specific criteria and response timelines for repair for each inspection element, including notification provisions of required repairs; as well as, provides insight and guidance into the measures that will be implemented to properly transport waste materials from the 10-Acre Pond, Site excavations, and demolition areas to the on-Site repository. This O&M Plan provides:

1. Basic construction information;
2. Waste hauling and dust control requirements;
3. A description of all required Site inspection and monitoring activities, including the frequency with which each activity will be performed and the corrective actions that will be taken for each problem encountered; and
4. A description of all required Site maintenance activities, including the frequency with which each activity will be performed.

This plan also minimizes the risk to both the environment and human health by addressing the means and methods that will be utilized to implement dust control measures, maintain equipment, and sustain clean work and road surfaces.

## **1.2 RESPONSIBILITY**

Pioneer Technical Services (Prime Contractor) is responsible for implementation of this plan and entering into a contract with the selected Construction Contractor. Greenfield Environmental Multistate Trust, LLC, Trustee of the Multistate Environmental Response Trust, (the Multistate Trust) is the Owner of the Site and is responsible for the control and implementation of the Site activities. Hydrometrics will provide independent QA as the Multistate Trust's representative during the Project.

## **1.3 COMMUNICATIONS**

Lines of communication between the Prime Contractor, Construction Contractor, inspectors, Design Engineer and the Multistate Trust will be established before construction at the Site begins. All communications, inspection logs, and incurred problems shall be documented and copies provided to the owner/operator.



#### **1.4 OPERATIONS LOG**

The Prime Contractor will maintain an operations record of all Site inspections and maintenance activities. Communications between the Prime Contractor, Construction Contractor, Design Engineer, the Multistate Trust and other inspections should be documented and kept as part of the operation log. This log will be provided to the Design Engineer and Multistate Trust.

#### **1.5 PUBLIC SAFETY AND HEALTH**

Site access is currently controlled using fences, gates, and signage to prevent public access. Fencing will be installed around the perimeter of the new on-Site repository to prevent unauthorized access. The Prime Contractor will be responsible for ensuring that the Site is secure and gates and fences will be inspected weekly to keep the Site secure.

## **2.0 CONSTRUCTION INFORMATION**

The on-Site repository consists of the following components listed in order from the bottom to the top of the cap:

1. Secondary Liner
  - Reinforced Geosynthetic Clay Liner (GCL)
2. Primary Liner
  - 60-mil Double Sided Textured HDPE flexible membrane liner (FML)
3. Leachate Collection and Removal (LCRS) System
  - 250-mil Geocomposite Drainage Layer
4. 3-foot Cushion Layer of Calcine Tailings
5. Waste
6. 12-inch Gas Migration Layer consisting of Calcine Tailings
7. Cap Composite Liner
  - Reinforced GCL liner
  - 60-mil Double Sided Textured HDPE FML
8. Surface Water Collection and Removal System (SWCRS)
  - 250-mil Geocomposite Drainage Layer
9. Cover System
  - 18-inch Cover Soil Layer
  - 6-inch Growth Media layer
  - Grass Cover

### **3.0 WASTE HAULING AND DUST CONTROL**

Waste Hauling and dust control measures are designed to control the emission of visible fugitive dust. These controls will be accomplished through the use of administrative, engineering, and physical controls. The mitigation of airborne dust generation is considered to be a priority. Throughout the Project, the necessary steps will be taken to effectively control dust in the working area during pond solids removal, building demolition, and excavation operations. The use of minimum amounts of water will be the main source for dust control.

#### **3.1 ON-SITE TRANSPORT**

Sorting and sizing of solid waste will occur at the removal/demolition site prior to being loaded in haul trucks. All oversized materials will be reduced at the removal/demolition site and once the debris and material is loaded into haul trucks, no further reduction of materials will be necessary. After all solid waste is loaded into the truck beds, any dust generating debris in the payload will be moistened prior to the vehicle leaving the loading area. The truck beds will utilize sealed tail gates. The use of truck bed covers may be considered if the physical shape of the truck beds accommodate. Transport vehicles will be limited to a maximum of 15 miles per hour (mph) while transporting waste to the repository. Limiting speeds will prevent dust from become airborne during transport and will prevent the kick-up of dust from rolling tire action.

#### **3.2 PLACEMENT OF WASTE**

Once haul trucks arrive at the on-Site repository, they will drive into the cell and dump their load in the location specified by the contractor. A water truck will be located close to the on-Site repository cell to lightly mist debris and knock down any dust during the dumping and spreading phase of the debris in the on-Site repository. Use of water will be kept to a minimum. Additional water will be applied to locations in the on-Site repository to eliminate the potential for fugitive dust emissions. Waste will be placed in the on-Site repository cell in 2-foot lifts and compacted according to Project Specifications. Inspections of the on-Site repository cell will occur at least twice daily to assess the potential for windblown dispersion

of fugitive dust. Water will be applied to areas of the cell where fugitive dust could potentially or is found to be a problem.

### **3.3 WORK STOPPAGE**

Work shall halt when weather conditions are such that the spread of contaminated dust and debris is likely. These conditions typically exist when there is excessive wind and/or rain. Therefore, if wind with sustained readings of 15 mph (average hourly rate) or more evolve, the handling and hauling of waste both on-Site and off-Site will halt to prevent dust and debris from becoming airborne due to the waste management process. Furthermore, if a rain event begins, management personnel will evaluate the Site conditions. If the rain is such that no run-off is occurring, work activities will proceed uninhibited. In the event that the rain is of such volume that run-off is beginning to occur and the work activities in progress (i.e., waste hauling, placement of waste in on-Site repository) could create a contaminated run-off, both on-Site and off-Site work will cease until such time that a run-off potential is not present. In the event that transport is halted, no additional trucks will be loaded and any trucks containing wastes will be covered until conditions improve.

### **3.4 DECONTAMINATION AND INSPECTION OF EQUIPMENT**

Equipment used in the handling and/or transport of contaminated debris will be decontaminated prior to the equipment leaving the Site. Decontamination pads, a concrete slab suitable for placement of heavy equipment, will be established, in areas agreed upon with and approved by the Design Engineer on behalf of the Multistate Trust. The location of the decontamination pads may change as demolition activities progress. However, all equipment will be decontaminated within close proximity to where it will leave the Site. Equipment that has been decontaminated will be inspected upon completion to ensure the adequacy of the process and to document the process to ensure quality control prior to the transport vehicle leaving the Site.

Decontamination will consist of one or a combination of the following: brushing, vacuuming, or washing methods. The goal of the decontamination is to remove Site contaminants of concern (COC) bearing dust and debris from the areas of the equipment that came into

contact with this waste. Upon completion of the decontamination activities, any removed dust and debris residue will be picked up and placed into the on-Site repository.

Transport vehicles will be inspected periodically to ensure that truck beds and gates are properly sealed and that debris is not building up.

Equipment used in the on-Site repository for spreading and compacting waste will be decontaminated within the on-Site repository prior to exiting.

#### **3.4.1 Work and Road Surface Cleaning**

Haul roads within the Site used for waste transport will need to be kept clean at all times. The haul roads will be inspected daily to make sure transport vehicles are being adequately decontaminated, waste is adequately moistened, and no fugitive debris is leaving the truck beds.

### **3.5 SPILL MITIGATION**

Spills of soils or debris being transported to the on-Site repository will be prevented by constant maintenance of trucks to make sure they are properly sealed and in good working order. In addition, traffic control and slow truck speeds, as previously mentioned will help to prevent accidents from occurring. If waste is spilled in route to the on-Site repository, the hauling of waste will halt and the spilled waste will be cleaned up using clean decontaminated equipment.

Daily inspections of the area surrounding the on-Site repository cell will include looking for visible fugitive emissions. If a release from the cell is noticed during an inspection, the waste will be cleaned up using clean decontaminated equipment and placed in the on-Site repository cell. Excavation of soils where visible waste is noticed will be conducted immediately.

#### **4.0 SURVEYING AND RECORDKEEPING**

The Prime Contractor will establish a permanent surveyed benchmark, which will be placed on the top of the on-Site repository once the final cap is complete. After the permanent surveyed benchmark is established, the contractor will publish a map to be kept on file in the operations record, which includes the exact location and dimensions, including depth of the cell.

## **5.0 CLOSURE PLAN**

This plan identifies the steps necessary to perform final closure of the on-Site repository. Final closure will be completed when all waste has been placed in the on-Site repository and it is ready for the permanent cover. The final cover has been designed and will be constructed in accordance with the substantive requirements of 40 CFR 258.60(a).

### **5.1 CLOSURE ACTIVITIES**

Before final closure of the on-Site repository, equipment used for placement of wastes inside the on-Site repository will be thoroughly decontaminated prior to leaving the on-Site repository. The haul roads used to move contaminated pieces of equipment will be thoroughly scraped after transport is complete to ensure that no contaminated residues remain on the roads. Other activities including, leachate collection monitoring, and run-on and runoff control will be monitored as outlined in Section 6.0 during the closure period.

### **5.2 CLOSURE SCHEDULES**

It will take one construction season at the Site before all waste is placed in the on-Site repository and the repository is ready for closure. Upon final receipt of waste to the on-Site repository, it should take approximately 30 days to place the final cover.

## **6.0 SITE MONITORING AND INSPECTION**

Inspections will be performed twice daily of areas surrounding the on-Site repository and the haul road between the on-Site repository and the 10-Acre pond/demolition areas when the on-Site repository is in operation. Daily inspections of the road used for hauling waste will occur when the haul road is in use. While the on-Site repository cell is in operation, it will be inspected once per week.

### **6.1 SITE INSPECTIONS – OPERATION**

#### **6.1.1 Daily Inspections**

While the on-Site repository is in operation, inspection of the grounds surrounding the on-Site repository should be inspected twice daily. These inspections should include an assessment of the potential for windblown dispersion of fugitive dust from the on-Site repository and a visual inspection of the grounds surrounding the on-Site repository for any visible releases of fugitive dust from the on-Site repository cell. The remainder of the haul road should be inspected once per day to ensure that it is free of dust and debris. Daily inspections should be documented and recorded on the Daily Inspection Form included in Attachment A of this Appendix and any problems found will be reported to the Multistate Trust and addressed immediately.

#### **6.1.2 Weekly Inspections**

While the on-Site repository is in operation, it must be inspected weekly and after significant storms to detect evidence of any deterioration, malfunctions, or improper operation of run-on and runoff control systems, and the proper functioning of or presence of liquids in the leachate collection system. Anchor trenches around the perimeter of the cover will be inspected for liner pullout. Sandbags will be inspected for proper spacing and damage. Inspection of the perimeter fence, gates, condition of haul roads, presence of precipitation run-off or ponded liquids, condition of decontamination pads, and the condition of haul trucks will be included in weekly inspections and any maintenance needed will be recorded on the Weekly Inspection Form included in Attachment A of this Appendix and addressed appropriately.



## **6.2 LEACHATE COLLECTION SYSTEM MONITORING**

The monitoring and maintenance of the on-Site repository leachate collection system will include removing liquids from the sump to minimize the head in the sumps and avoid backup into the waste layer. The Prime Contractor will record pre- and post-pumping water levels and the amount of liquids removed from the leachate collection system sump. The amount of liquids removed will be recorded on the repository inspection form (Attachment A).

The Prime Contractor will ensure that the depth of leachate does not exceed 12 inches over the primary liners by monitoring leachate depth in the leachate collection sump. If the depth of the leachate in the sump is at or near 12 inches, the contractor will pump the sump and use or dispose of leachate by recirculating the leachate to waste within the on-Site repository or if necessary, hauling offsite to a hazardous waste facility for disposal.

## **6.3 CORRECTIVE ACTION FOR IDENTIFIED PROBLEMS**

If any problem or deficiency is found during any inspection type, the following procedures will be followed. The inspector will record the location on a field sketch and will record a complete description of the affected area, including all pertinent data (i.e., size of the area and other descriptive remarks such as exposed synthetic materials, and odors, etc.) on the appropriate reporting forms. An accurate and detailed description of observed conditions will enable a meaningful comparison of conditions observed at different times. This information has three elements.

1. Location - The location of any questionable area or condition will be accurately described so that the area or condition can be evaluated for changes over time, repaired, or reexamined by experts.
2. Extent or Area - The length, width, and depth or height of any suspected problem area will be measured.
3. Descriptive Detail - A brief, but detailed description of the anomalous condition will be given.

Photographs are helpful in documenting problems. The Prime Contractor will keep a photographic log of problems, repairs, and general Site conditions. This log will provide valuable information when evaluating the long-term performance of the cover system and when planning repair strategies.

If any problems are encountered during routine inspections, they will be documented on the Inspection/Repair form and the Design Engineer and the Multistate Trust will be notified within 24 hours. The Prime Contractor is responsible for making sure all repairs are scheduled and/or completed within 14-calendar days of the inspection. Details of completed repairs will be noted on the Inspection/Repair form.

## **7.0 SITE MAINTENANCE**

### **7.1 GENERAL**

This section provides guidelines for instituting and understanding the need for an effective maintenance program. The objectives of such a maintenance program are to:

1. Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events;
2. Ensure reliability of operation and limit environmental impacts;
3. Protect and extend the useful life of the on-Site repository structure; and
4. Ensure public health and safety.

#### **7.1.1 Importance of Maintenance**

The on-Site repository structure represents a substantial investment to protect the public health and environment of the areas surrounding the Site. One of the important factors to minimizing environmental impacts resulting from the Site is a sound maintenance program. A sound maintenance program has the added benefit of identifying problems before they become emergencies.

#### **7.1.2 Types of Maintenance**

As shown in Table 7-1, there are four types of maintenance listed by priority rather than by frequency. Table 7-1 is provided as a guide to help put the types of maintenance into proper perspective. The different types of maintenance are also discussed in the following subsections.

**TABLE 7-1. PRIORITY OF MAINTENANCE TASKS**

Priority	Type of Maintenance	Description and Example
1	Emergency	A situation requiring immediate attention (for example, fire, earthquake, or flood).
2	Preventative	Scheduled inspection and minor repairs carried out during inspection (for example, cleaning of gutters and culverts).
3	Corrective	Corrective maintenance required as a direct result of scheduled inspection (for example, repair of torn membrane liner).
4	Housekeeping	Routine housekeeping of buildings and grounds (for example, mowing grass, painting, and general housekeeping).

1. Emergency maintenance - Emergencies are situations arising unexpectedly that require urgent attention. Often, immediate response must be provided to avert potential serious damage. Provisions for emergency repair/damage control activities and an Emergency Contacts list will be prepared and kept current with a list of phone numbers for local emergency response organizations, lining contractors, and agency and owner representatives. Table 7-2 provides a list of Emergency Contacts.
2. Preventative maintenance - Preventative maintenance is work done to extend the life of equipment and structures. With the exception of routine surveillance and inspections, preventative maintenance tasks will be scheduled in accordance with the recommendations of the material and equipment manufacturers. Scheduled inspection and maintenance of all Site facilities will help ensure that potential problems are discovered and corrected before they become serious, as well as providing for the performance of periodically required upkeep. During routine inspections, the property managers will be alerted for any abnormal conditions, which could indicate potential problems.

**TABLE 7-2. EMERGENCY NOTIFICATION  
CONTACTS AND PHONE NUMBERS**

**General Emergency Numbers**

Fire Department	911
Ambulance	911
Police	911

**Owner**

**Multistate Trust:**

Cindy Brooks	(617) 448-9762
Tasha Lewis	(602) 312-6993
Lars Peterson	(480) 319-3638

**Design Engineer**

**Hydrometrics:**

Mark Rhodes	(406) 431-1637
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**Prime Contractor**

**Pioneer Technical Services:**

Joel Gerhart	(406) 490-2530
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**Other Resources**

Scott Rigby	(208) 221-4340
EPA (24-hour emergency)	(206) 553-1263
Superfund/RCRA Hotline	(800) 424-9346

3. Corrective maintenance - Corrective maintenance is the work required for repairs and other non-routine maintenance. The on-Site repository contractor will handle these tasks as the need arises. Corrective maintenance procedures will follow the equipment or material manufacturer's recommendations. In planning for the corrective maintenance, the contractor will arrange for advice or assistance from an engineer or manufacturer's representative.
4. Housekeeping - Maintaining well-kept Site closure facilities indicates pride on the part of the on-Site repository owner and cultivates good neighbor relations with adjacent property owners. Housekeeping tasks include controlling weeds, sweeping pavement surfaces, and collecting/disposing of litter or debris.

### **7.1.3 Maintenance Log**

A maintenance log will be maintained by the contractor as part of the on-Site repository Operations Record.

## **7.2 REPOSITORY PERMANENT CAP**

Once the 10-Acre Pond removal action and other remedial actions or activities have been completed, the existing O&M Plan for the Site will be updated to include long-term O&M requirements related to the removed 10-Acre Pond and new on-Site repository. Ongoing O&M activities will be modified to include any necessary work related to this project, the results of which will continue to be provided to EPA and IDEQ in regular monthly progress reports for the Site.

## **ATTACHMENT A**

### **INSPECTION FORM AND SITE MAP**

## REPOSITORY INSPECTION CHECKLIST

AREA INSPECTED	Cell		Inspected by: _____	Date: _____		
	ITEM NO.	CONDITION	OBSERVATION	ACTION NEEDED (Check)		
				MONITOR	INVESTIG.	REPAIR
UPPER SURFACE	1	Surface Cracking				
	2	Animal Burrows				
	3	Low Area				
	4	Ruts or Puddles				
	5	Vegetation Condition				
	6	Noxious Weeds				
	7	Settlement/Subsidence				
	8	Erosion				
SIDE SLOPE	1	Slide, Slough, Scarp				
	2	Animal Burrows				
	3	Erosion				
	4	Vegetation Condition				
	5	Noxious Weeds				
	6	Exposed Liner				
	7	Seepage				
	8	Fencing				
	9	Settlement/Subsidence				
Additional Comments:						



## REPOSITORY INSPECTION CHECKLIST

AREA INSPECTED	Cell		Inspected by: _____	Date: _____		
	ITEM NO.	CONDITION	OBSERVATION	ACTION NEEDED (Check)		
				MONITOR	INVESTIG.	REPAIR
STORM WATER CONVEYANCE	1	Toe Ditches - Obstruction due to vegetation/sedimentation				
	2	Toe Ditches - evidence of erosion				
	3	Drainage Pipes				
LEACHATE COLLECTION SYSTEM/MONITORING WELLS	1	Condition of Leachate Sump				
	2	Leachate Collection Sump-Depth				
	3	Monitoring Wells - Condition of Protective Surface Casing				
	4	Monitoring Wells - Presence of Locks				
Additional Comments:						

## **APPENDIX F**

### **HEALTH AND SAFETY PLAN**

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**KERR-MCGEE CHEMICAL CORP.  
SODA SPRINGS PLANT SUPERFUND SITE**

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***Draft***

***Site-Wide Health, Safety, Security, and  
Environment (HSSE) Program Plan***

Prepared by:

**Pioneer Technical Services, Inc.**

Prepared for:

**Greenfield Environmental Multistate Trust, LLC  
Trustee of the Multistate Environmental Response Trust**

**March 7, 2018**

## **Disclaimer**

The purpose of this Site-Wide Health, Safety, Security, and Environmental (HSSE) Program Plan (HSSE Plan) is to provide general guidelines for preserving health, safety, and the environment during work activities at the Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site (Site). Each Site contractor is not responsible for the means and methods used to implement this HSSE Plan. Each contractor will be responsible for addressing and mitigating all job-specific risks and hazards related to the activities they, or their subcontractor(s), are performing on the Site. This HSSE Plan has been developed given current and reasonably available information. Pioneer Technical Services, Inc. (Pioneer) accepts no responsibility for other contractors performing work on the Site.

By signing this HSSE Plan Acknowledgement Page, I acknowledge that I have reviewed and understand the hazards and mitigations associated with the Site as described in this document. I will follow all applicable safety policies and procedures while working on this Site.

**Print Name**

**Signature**

Date

[illegible]

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## APPENDICES

Appendix A	Project-Level Work Risk Assessment
Appendix B	SIMOPS Meeting Record Form
Appendix C	Example of a Daily Toolbox Meeting Record Form

Revision No.	Author	Version	Description	Date
Rev. 0	Patty Navarro and Thomas Brown	Draft	Issued for Multistate Trust review.	March 7, 2018

## ACRONYMS AND ABBREVIATIONS

Acronym/ Abbreviation	Description
°F	Degrees Fahrenheit
ALARA	As Low As Reasonably Achievable
ATSDR	Agency for Toxic Substances and Disease Registry
CFR	Code of Federal Regulations
C	ceiling limits; short-term exposure limits
DHHS	Department of Health and Human Services
DNRC	Department of Natural Resources and Conservation
GET	Global Environmental Technologies LLC
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSSE	Health, Safety, Security, and Environment
mg/m <sup>3</sup>	milligram per cubic meter
Multistate Trust	Greenfield Environmental Multistate Trust, LLC, Trustee of the Multistate Environmental Response Trust
NORMs	Naturally Occurring Radioactive Materials
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
Pioneer	Pioneer Technical Services, Inc.
PPE	Personal Protective Equipment
Site	Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site
SIMOPS	Simultaneous Operations
SDSs	Safety Data Sheets
SPF	Sun-protection factor
TBP	Tributyl Phosphate
TENORM	Technologically Enhanced Naturally Occurring Radioactive Materials
TPH	Total Petroleum Hydrocarbon
TWA	8-hour time-weighted average
UV	Ultraviolet
WRA	Work Risk Assessment



# **1 PURPOSE**

The purpose of the HSSE Plan is to address general hazards and risks associated with the Site located at 1864 Highway 34, approximately 2 miles north of Soda Springs, Caribou County, Idaho. The document also identifies the appropriate mitigation measures and controls to eliminate and/or reduce identified hazards and risks.

The HSSE Plan was developed in accordance with the Occupational Safety and Health Administration (OSHA) regulations for Hazardous Waste Operations and Emergency Response (HAZWOPER) found in Title 29 of the Code of Federal Regulations (CFR) Part 1926.65 (OSHA, 2016).

The document describes roles and responsibilities, project-level hazards and risks, mitigation measures, security elements, emergency response procedures, training requirements, and health and safety plan (HASP) requirements for Site contractors. The document also provides specific provisions and measures needed to comply with the Greenfield Environmental Multistate Trust, LLC, Trustee of the Multistate Environmental Response Trust (Multistate Trust) *Health and Safety Plan for Kerr-McGee Chemical Superfund Site, Soda Springs, Idaho* developed by Global Environmental Technologies LLC (GET) (GET, 2011).

## **2 SCOPE OF WORK**

The HSSE Plan is for all contractors and subcontractors working on the Site. The document is designed to evaluate general hazards, risks, and mitigation measures associated with the Site. General work activities to be conducted at the Site include building and demolishing Site infrastructure, removing the 10-acre pond, excavating waste materials, repository construction, drilling activities, reclamation and capping, Site regrading and constructing storm water controls, housekeeping, and groundwater and soil sampling.

It is the responsibility of each contractor and its subcontractors to evaluate the job-level hazards, risks, and mitigation measures associated with their specific work activities.

## **3 SITE LOCATION AND CHARACTERIZATION**

The Site is located north of and adjacent to the City of Soda Springs, Idaho (Figure 1) and comprises approximately 150 acres, of which 50 acres contain structures and facilities proposed for demolition (Figure 2). The Site is located east of State Highway 34, approximately 3 miles north of the intersection with U.S. Highway 30. The Monsanto Chemical Company Soda Springs, Idaho phosphate processing plant is located west of the Site along Highway 34. Crop and rangeland are found on the north, east, and south sides. All Work will be completed on private lands owned by the Multistate Trust.

## 4 SITE ROLES AND RESPONSIBILITIES

### 4.1 *Multistate Trust Project Manager*

**Lars Peterson** is the Multistate Trust Project Manager for the Site and is responsible for general oversight of the project, Site management activities, and ensuring flow of information between all contractors completing work on the Site. The Multistate Trust Project Manager will communicate and coordinate all simultaneous operations (SIMOPS) with all relevant Contractor Project Managers/Coordinators. The Multistate Trust Project Manager will involve and inform the Multistate Trust Portfolio Manager, **Tasha Lewis**, in all Site safety and project-related issues, as necessary.

### 4.2 *Contractor Project Managers/Coordinators*

The Contractor Project Managers/Coordinators are responsible for coordinating their work activities (whether completed by their company or any of their subcontractors) as needed with the Multistate Trust Project Manager.

### 4.3 *Person in Charge/SIMOPS Site Lead*

The Person in Charge (PIC)/SIMOPS Site Lead is responsible for coordinating Site activities that interact with those being completed by other contractors. The PIC/SIMOPS Site Lead will be a specific individual as designated on the SIMOPS Meeting Record Form, who has a close working relationship with all Contractor Project Managers/Coordinators and any other on-Site personnel (see Section 6.3).

### 4.4 *Workforce*

All contractors and subcontractors will carry out the duties assigned by an authority to proper specifications and in a safe manner. All Site personnel will be responsible for adhering to all aspects of the HSSE Plan, including compliance with Site safety rules and regulations. All personnel will STOP WORK, if any task appears potentially unsafe, or if task requirements and/or field conditions change, in order to reevaluate hazards and implement appropriate mitigations. Those working in the field will inspect the Site prior to commencing work and actively monitor the Site and its surroundings for changes that might affect the performance of the task. Also, personnel will report all allegations or occurrences of unsafe work, near misses, and any opportunities to improve unsafe work environments to their supervisors. Personnel will be responsible for reporting missing, poorly fitting, or broken Personal Protective Equipment (PPE).

### 4.5 *Visitors*

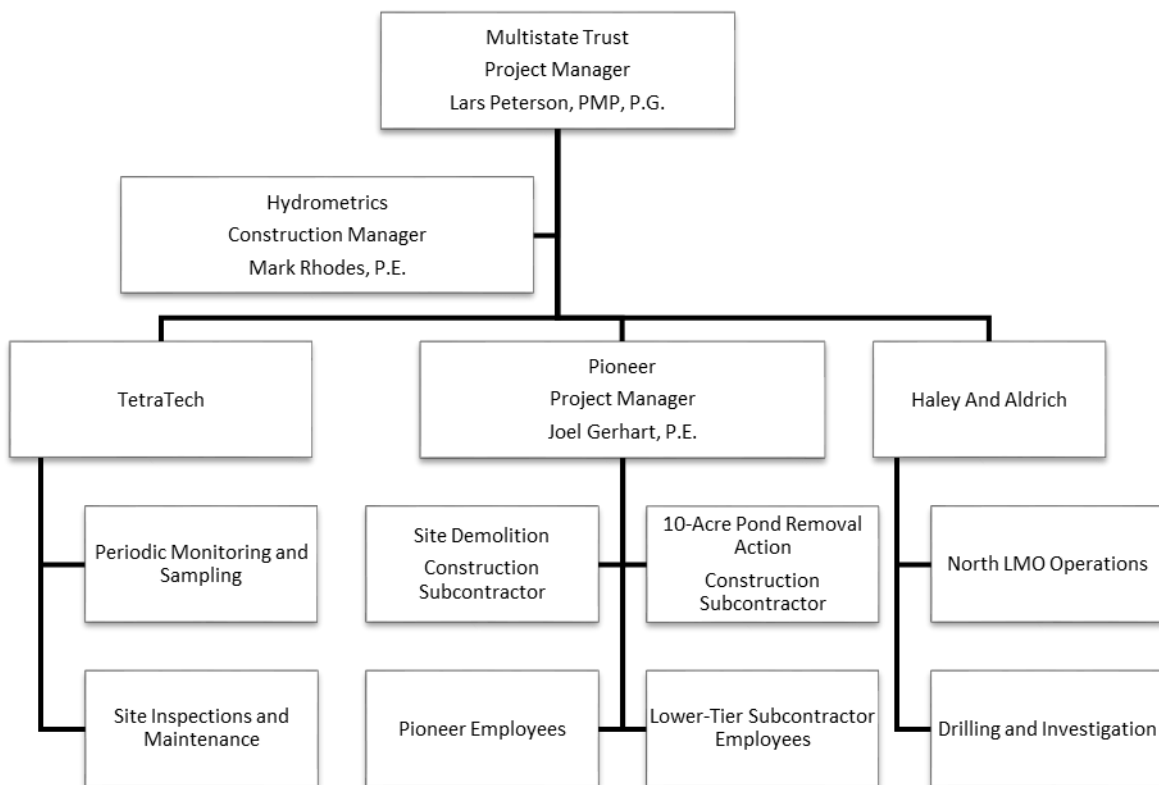
The responsibilities of Site visitors include, but are not limited to, the following:

- Cooperate with Site requirements (e.g., pre-entry briefing, established work zones, PPE, etc.).
- Understand the hazards, risks, and mitigation measures identified for the Site.

- Participate in scheduled tours/visits while accompanied by a Site representative always.
- Sign in and check in with the PIC/SIMOPS Site Lead prior to entering the Site.
- Check out with the PIC/SIMOPS Site Lead when leaving the Site.

## 4.6 Site Organization

The Site organization is as follows:



## 5 HAZARD ASSESSMENT AND CONTROLS

The following general safety requirements apply to all work at the Site always. All contractors, subcontractors, other Site personnel, and Site visitors shall comply with the following:

- Individuals will wear high-visibility vests/clothing, safety glasses, hard hats, long pants, long-sleeved work shirts, appropriate gloves, and appropriate safety-toed footwear.
- Individuals will not operate cellular phones while driving on the Site.
- Individuals will observe a maximum speed limit of 15 miles per hour (mph) when driving on Site roads, or as otherwise posted.
- Individuals will wear safety belts always when driving or riding in a vehicle or operating equipment, including on trips to and from the Site.
- First aid kits and fire extinguishers are required in all field vehicles and equipment.
- No drugs, alcohol, or firearms are allowed on the Site or in vehicles.
- No eating or drinking is allowed in the work area(s).

Appendix A includes the Project-Level Work Risk Assessment (WRA) that evaluates the general hazards, risks, and mitigation measures associated with the Site.

All personnel working on the Site will be trained and competent on the jobs and tasks they will perform. It is the responsibility of the Site contractors and subcontractors to develop their own HASP and job-level WRA to evaluate the hazards and risks associated with the work activities that they will be completing on the Site. These health and safety plans and WRAs will be revised as appropriate, for example, following a change in the job and appearance of a new hazard.

The following sections discuss the Site-wide hazards, risks, and mitigation measures.

### 5.1 *Biological Hazards*

Biological hazards wildlife, plants, and insects. Personnel might be exposed to wildlife, such as snakes, birds, deer, and mice while working on the Site. Spiders and insects such as ticks, bees, and hornets might also be encountered. Personnel will avoid contact with wildlife, as needed, by leaving the area and/or getting in vehicles until animals are no longer present.

Site personnel will understand the signs and symptoms of exposure to plants and insect bites (e.g., redness and swelling), know the location of first aid kits, and will use the kits to treat minor bites, stings, scrapes, and cuts. Personnel will report all bites, stings, and other personal injuries to their corresponding supervisor. Personnel with allergies will also notify their supervisor to ensure proper treatment in the event of a bite, sting, exposure to plants/weeds, or other allergic reactions.

Pigeon/bird droppings may also be encountered in several buildings on the Site. When possible, personnel will avoid walking in areas where droppings are present. Personnel will also avoid

generating dust when accessing buildings. If necessary, personnel will clean the area with a bleach solution prior to starting work.

## 5.2 Chemical and Mineral Hazards

Personnel might be exposed to heavy metals via exposure to impacted soil, sediments, and surface water. Heavy metals present at the Site include, but are not limited to, the following:

- Arsenic.
- Cobalt.
- Copper.
- Lead.
- Manganese
- Molybdenum.
- Nickel.
- Titanium.
- Vanadium.

Potential exposure pathways for these heavy metals include skin absorption, inhalation, and ingestion. Skin absorption could occur due to direct contact with impacted soil, sediments, or surface water. Personnel working on the Site could inhale suspended dust generated due to heavy equipment in operation and vehicle traffic at the Site. Inadvertent ingestion of heavy metals is possible due to hand-to-mouth activity and poor personal hygiene. Site buildings may also contain lead-based paints.

Table 5-2 describes the primary health and physical hazards associated with the heavy metals listed above.

**Table 5-2. Primary Health and Physical Hazards Associated with Heavy Metals**

Heavy Metal	Primary Health and Physical Hazards	OSHA PEL
<b>Arsenic</b>	<ul style="list-style-type: none"> <li>• Short-term exposure to arsenic can irritate the eyes, skin, and respiratory tract.</li> <li>• Long-term or repeated exposure to the skin may cause dermatitis.</li> <li>• It may cause negative effects on the nervous and circulatory systems.</li> </ul>	<ul style="list-style-type: none"> <li>• TWA 0.01 mg/m<sup>3</sup> (DHHS, 2012).</li> </ul>
<b>Cobalt</b>	<ul style="list-style-type: none"> <li>• Irritation of the nose and throat.</li> <li>• Respiratory disease with symptoms ranging from cough and shortness of breath to permanent disability.</li> <li>• Non-combustible solid in bulk form, but finely divided will burn at high temperatures.</li> </ul>	<ul style="list-style-type: none"> <li>• TWA 0.1 mg/m<sup>3</sup> (DHHS, 2012).</li> </ul>
<b>Copper</b>	<ul style="list-style-type: none"> <li>• Short-term exposure may cause a feeling of illness similar to the common cold with sensations of chills and stuffiness of the head.</li> </ul>	<ul style="list-style-type: none"> <li>• TWA 1 mg/m<sup>3</sup> (DHHS, 2012).</li> </ul>

Heavy Metal	Primary Health and Physical Hazards	OSHA PEL
	<ul style="list-style-type: none"> <li>Long-term exposure may cause skin irritation or discoloration of the skin or hair.</li> </ul>	
<b>Lead</b>	<ul style="list-style-type: none"> <li>High levels may cause anemia, weakness, and kidney and brain damage.</li> </ul>	<ul style="list-style-type: none"> <li>TWA 0.050 mg/m<sup>3</sup> (DHHS, 2012).</li> </ul>
<b>Manganese</b>	<ul style="list-style-type: none"> <li>Prolonged or repeated exposure may affect the nervous system.</li> </ul>	<ul style="list-style-type: none"> <li>C 5 mg/m<sup>3</sup> (DHHS, 2012).</li> </ul>
<b>Molybdenum</b>	<ul style="list-style-type: none"> <li>Eye, nose, throat, and skin irritation.</li> </ul>	<ul style="list-style-type: none"> <li>TWA 5 mg/m<sup>3</sup> (DHHS, 2012).</li> </ul>
<b>Nickel</b>	<ul style="list-style-type: none"> <li>May cause an allergic skin rash and allergic asthma.</li> </ul>	<ul style="list-style-type: none"> <li>TWA 1 mg/m<sup>3</sup> (DHHS, 2012).</li> </ul>
<b>Titanium</b>	<ul style="list-style-type: none"> <li>Contact with skin or eyes may cause irritation.</li> </ul>	<ul style="list-style-type: none"> <li>Not reported.</li> </ul>
<b>Vanadium</b>	<ul style="list-style-type: none"> <li>Eye and throat irritation.</li> </ul>	<ul style="list-style-type: none"> <li>TWA 0.05 mg/m<sup>3</sup> (DHHS, 2012).</li> </ul>

OSHA: Occupational Safety and Health Administration

PEL: Permissible Exposure Limit

TWA: 8-hour time-weighted average

C: ceiling limits; short-term exposure limits

mg/m<sup>3</sup>: milligram per cubic meter

CDC: Centers of Disease Control and Prevention

Site personnel could be exposed to total petroleum hydrocarbon (TPH) and tributyl phosphate (TBP) due to inadvertent contact with contaminated soils and Site debris. Direct contact with these contaminants may cause irritation of the eyes, nose, and throat.

Asbestos could also be present within abandoned buildings' floor tiles, other building materials and/or insulation and soils. Potential exposure pathway for asbestos is via inhalation. Normal wear with age will dislodge fibers and allow them to become airborne. Secondary exposure to settled dust from previous disturbance, contaminating clothing, tracked dust, etc. is also a potential inhalation exposure pathway for asbestos.

To prevent exposure and adverse health effects from heavy metals, TPH, TBP, and asbestos, personnel will follow the procedures below:

- Wear PPE as outlined in Section 6.6 of this document.
- Practice proper personal hygiene techniques (i.e., wash hands and face before eating/drinking and applying makeup/sunscreen) while working on the Site.
- Stand upwind to prevent inhalation of dust.
- Suspend work activities during high-wind conditions that produce large amounts of visible dust.
- Follow the decontamination procedures outlined in Section 6.9.

It is recommended to use clean water to suppress dust during work activities that may generate visible dust (e.g., hauling, excavation, soil sampling, cleaning activities, etc.). If dust is visible after wetting, personnel should wear respirators as dictated by the task to be performed and contractor's health and safety plans and risk assessments.

If direct contact with soils, sediments, and/or surface water occurs, thoroughly wash the affected area with water and flush eyes with water.

Personnel could be exposed to carbon monoxide (CO) while working near equipment or idling vehicles. Carbon monoxide is a colorless, tasteless, and odorless gas that mixes evenly with air. It is produced anytime a carbon-based fuel such as diesel, gasoline, propane, or oil burns. Carbon monoxide can build up in enclosed and semi-enclosed areas, including excavations. During project activities, minimize the time sitting in idling vehicles. If you are in an idling vehicle for long periods of time, open a window to increase ventilation. During excavation, the operator will turn the engine off when possible to prevent accumulation of CO. Early signs and symptoms of exposure to CO include irritated eyes, headache, nausea, weakness, and dizziness. If these symptoms are experienced, move to fresh air and seek medical attention if necessary.

Exposure to diesel and gasoline can occur while refueling vehicles and equipment. Inadvertent exposure to diesel and gasoline via inhalation and/or skin contact can result in adverse health effects and skin irritation. To avoid exposure, personnel will fill vehicles/equipment with gasoline or diesel only in well-ventilated areas, stand up wind while fueling, and minimize splash hazards so skin contact does not occur. If skin contact does occur, flush affected area with clean water.

Exposure to hydraulic fluids/fuels can occur when working/walking around equipment due to equipment malfunction/failure. The primary route of exposure to hydraulic fluids/fuels is skin/eye contact and puncturing of the skin due to pressurized fluids. Contact with hydraulic fluids/fuels can cause personal injuries, including skin and eye irritation, and injection injuries if hydraulic fluids/fuels penetrate the skin. Operators will inspect equipment and document inspections daily before use. Equipment operators will replace/repair all faulty equipment before starting work. When inspecting equipment, personnel will wear work gloves to prevent possible exposures to hydraulic fluids. If a spill occurs during work, immediately stop all activities. Equipment owner/operator will cleanup all spills and spill kits will be readily available on the Site. Ground personnel will maintain a safe buffer zone around moving equipment as mandated by the contractor operating the equipment. If exposure occurs, thoroughly wash the affected area with clean water.

All personnel will follow the hazard communication requirements in accordance with the OSHA regulations found in Title 29 CFR Part 1926.59 (OSHA, 2016). Safety Data Sheets (SDSs) will be maintained in a binder located on the Site in the Main Office Building. Site contractors are responsible for adding SDS specific for their work.

### **5.3 *Gravitational Hazards***

Personnel may encounter or need to walk on uneven terrain and in slippery/muddy/standing water conditions. As a result, slips, trips, and falls could occur resulting in bodily injuries. To avoid these hazards, personnel will wear safety-toed footwear with good traction and ankle support that are appropriate for the weather conditions. Personnel will also plan their path, if possible avoid steep, rugged and/or muddy terrain, and practice good housekeeping to prevent other tripping hazards.

Buildings with high walls and ceilings are present at the Site. Accessing unprotected sides and edges from Site buildings could result in falls and serious personal injuries. If personnel need to walk/work on surfaces with an unprotected side or edge which is 6 feet or more above a lower level, they will be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems as outlined in the OSHA regulations found in Title 29 CFR Part 1926 Subpart M – Fall Protection (OSHA, 2016). Access to these surfaces using scaffolds/aerial lifts and ladders will be done following the OSHA regulations outlined in Title 29 CFR 1929 Subpart L – Scaffolds, Subpart T – Demolition, and Subpart X – Stairways and Ladders (OSHA, 2016).

Personnel walking on the Site may encounter open trenches. Falling in open trenches could result in serious personal injuries. To prevent falls, personnel will walk cautiously, and if possible avoid areas with open trenches or stay at least 6 feet back from the edge of open trenches. When necessary, personnel will install a warning line with ropes or caution tape. This warning line will be placed 6 feet back from the edge of the open excavation.

## **5.4 Motion Hazards**

### **Driving Hazards**

Personnel will interact with public traffic when entering and exiting the Site and could also encounter heavy equipment traffic within active work areas. As a result, vehicle incidents could occur. Personnel required to drive on the Site will drive cautiously, obey posted traffic signs, and check in at the Main Office Building and verify traffic patterns and/or restricted areas with the PIC/SIMOPS Site Lead, as appropriate.

Personnel might be required to drive off-road on sloped, bumpy, and slick terrain to access work areas. Vehicles could become stuck and/or slide off access roads resulting in injury and/or property damage. Personnel will drive slowly and if vehicle is equipped with 4-wheel drive, personnel will use it when driving in slick muddy conditions to minimize potential of getting stuck.

An active railroad intersection exists at the main Site entrance. All personnel will observe traffic laws and controls at the railroad crossings. Personnel will stop, look, and listen before crossing the track. Personnel will also stop when railroad crossing lights are flashing or when crossing arms are lowered.

### **Heavy Equipment Hazards**

Ground personnel could be struck by and/or caught-between machinery when working/walking near active heavy equipment resulting in serious bodily injuries or death. Personnel will practice the following when working/waking near heavy equipment:

- Be aware of your surroundings and watch out for moving equipment.
- Stay in your vehicle, if possible.
- Maintain a safe buffer zone around moving equipment as mandated by the contractor operating the equipment.



- Before approaching the equipment, communicate with the operator by establishing eye contact and waving.
- Approach equipment only when it is not in motion and it is safe to approach. For example, when the excavator bucket is on the ground and the operator has signaled that it is safe to approach.
- Do not walk/work under a suspended load.
- Watch for shifting or unstable loads and surfaces.
- Wear high-visibility clothing.

## 5.5 *Radiological Hazards*

Naturally Occurring Radioactive Materials (NORMs) and Technologically Enhanced NORM (TENORM) could be on the Site in the form of the following radionuclides:

- $^{226}\text{Radium}$
- $^{228}\text{Radium}$
- $^{234}\text{Uranium}$
- $^{235}\text{Uranium}$
- $^{238}\text{Uranium}$

Levels are expected to be non-existent or low based on history of the operations.

Exposure to NORM/TENORM may occur via contaminated soils and sediments, which could result in adverse health effects. Potential exposure pathways include skin absorption, inhalation, and ingestion. Skin absorption could occur due to direct contact with impacted soil and sediments. Personnel working on the Site could inhale suspended dust generated due to heavy equipment in operation and vehicle traffic at the Site. Inadvertent ingestion of contaminated soils and sediments is also possible due to hand-to-mouth activity and poor personal hygiene.

To protect against the negative effects of radiation emitted from the Site's potential radioactive sources, all personnel will follow the As Low As Reasonably Achievable (ALARA) method of radiation protection. The following ALARA methods to reduce exposure apply:

- **Time:** keep the time spent around a radioactive source to a minimum. If time is cut in half, then exposure is cut in half, provided all other factors remain constant.
- **Distance:** increase the distance from a radioactive source. For gamma radioactive sources, the inverse square law relates the radiation exposure rate to distance. For example, doubling the distance from a radioactive source reduces the exposure to one-fourth its original value.
- **Shielding:** use materials as a shield to reduce the radiation reaching someone working around a radioactive source.

Personnel will practice the following safety radiation requirements to minimize exposure to radioactive sources:

- Only authorized personnel will enter the Site.
- If certain tasks (e.g., note taking, phone calls, etc.) can be completed elsewhere, complete these tasks in your field vehicle.

- Practice proper personal hygiene techniques (i.e., wash hands and face before eating/drinking, smoking and applying makeup, and eating and smoking in areas designated by the Contractor Project Managers/Coordinators) while working on the Site.
- Stand upwind to prevent inhalation of dust.
- Stop field activities during high wind conditions that produce large amounts of visible dust.
- Wear PPE as outlined in Section 6.6 of this document.
- Follow the decontamination procedures outlined in Section 6.9.

Personnel might be exposed to ultraviolet (UV) radiation from the sun. The hazards associated with UV radiation are burns and eye and skin damage. All personnel should use sunscreen with high sun-protection factor (SPF) greater than 15. Also, personnel working on the Site will wear long-sleeved shirts, long pants, and sun visors, as appropriate. Personnel will wear safety glasses with tinted lenses and UV protection, if necessary.

## 5.6 *Thermal Hazards*

During winter months, personnel may be exposed to cold temperatures that could result in the following cold-related injuries:

- **Frostbite:** occurs when body tissue freezes from exposure to cold conditions. Superficial frostbite is characterized by white, waxy, or grayish-yellow patches on the affected areas, and the skin feels cold and numb. Treat superficial frostbite by taking the victim inside, removing any constrictive clothing items and jewelry that could impair circulation, and seeking medical attention immediately. Deep frostbite usually affects the feet or hands; it is characterized by waxy, pale, solid skin, and sometimes blisters. Treat deep frostbite by moving the victim indoors and seeking medical attention immediately.
- **Hypothermia:** occurs when the body's temperature drops below 95 degrees Fahrenheit (°F). Symptoms of hypothermia include the following: change in mental status, uncontrollable shivering, cool abdomen, and a low core body temperature. Severe hypothermia may also produce rigid muscles, dark and puffy skin, irregular heart and respiratory rates, and unconsciousness. Treat hypothermia by protecting the victim from further heat loss, replacing wet clothing with dry clothing, and seeking medical attention immediately.

During summer months, personnel may be exposed to hot temperatures that could result in heat-related illnesses. Heat-related illnesses include a spectrum of disorders from environmental heat exposure. They include minor conditions such as heat cramps, heat rash, heat syncope (fainting because of heat exposure), heat exhaustion, and the more severe condition known as heat stroke. Heat stroke is defined as a body temperature of greater than 105.1 °F due to environmental heat exposure. The risk of heat-related illnesses can be reduced by observing the following precautions to avoid overheating and dehydration:

- Wear light, loose-fitting clothing to allow perspiration to evaporate and cool the body.
- Drink plenty of liquids to replace fluids lost from sweating.
- Use an air-conditioned vehicle or the Site's office building to cool down if needed.

Many of the buildings at the Site provide working space away from wind and outside elements, and the office building can be used for periodic breaks.

Driving and/or parking vehicles on dry grass/vegetation could cause grass fires resulting in personal injury or property damage. Personnel will only drive on designated roads and will not park in areas of dry/dead vegetation. If necessary, personnel can monitor the Department of Natural Resources and Conservation (DNRC) website and follow all applicable fire restrictions as warranted based on fire danger or restrictions.

## **5.7 *Pressure Hazards***

Personnel could be exposed to pressurized hydraulic hoses when working around heavy equipment. Hydraulic hoses could burst resulting in inadvertent contact with hydraulic fluid or being struck by the hose. Ground personnel will maintain a safe buffer zone around active equipment as mandated by the contractor operating the equipment. Personnel will wear PPE as outlined in Section 6.6 of this document.

Exposure to elevated noise levels could occur when working around heavy equipment and loud tools, which may result in hearing damage. If there are elevated noise levels in the work area, implement the following the controls:

- If you have difficulties hearing or understanding a normal tone of voice at a distance of approximately 3 feet, noise levels are probably exceeding safe levels and you should use hearing protection (e.g., earplugs).
- Maintain a safe buffer zone around heavy equipment as mandated by the contractor operating the equipment.
- If possible, get inside a field vehicle to reduce noise exposure.

Hearing protection will be administered and used in accordance with the OSHA occupational noise exposure requirements found under Title 29 CFR Part 1926.52 (OSHA, 2016).

## **5.8 *Electrical Hazards***

Underground and overhead utilities are present on the Site. Machinery contact with underground and overhead utilities can result in serious personal injuries and property damage. Personnel conducting work activities and operating equipment that could come in contact with underground and overhead utilities will exercise caution to avoid and prevent any damage to the utilities by following the OSHA requirements outlined in Title 29 CFR 1929 Subpart V – Power Transmission and Distribution (OSHA, 2016).

Contact with energized electrical wires and their components could result in serious personal injuries and property damage. Certified electricians will conduct all electrical work activities at the Site, if required. All electrical work will be conducted by following the OSHA regulations described in Title 29 CFR Part 1926 Subpart K – Electrical (OSHA, 2016).

Personnel could be exposed to lightning during the spring, summer, and fall months. During lightning storms, personnel will follow the 30-30 rule to minimize the risk of shock/electrocution. The 30-30 rule involves the following:

- Once lightning is observed, count the number of seconds until thunder is heard.
- If thunder is heard in 30 seconds or less, stop work and go indoors/take shelter.
- Do not return to outside activity until 30 minutes after hearing the last thunder.

## **6 SITE-SPECIFIC REQUIREMENTS/PROCEDURES**

The sections below describe requirements and procedures to be completed that are specific to this Site.

### **6.1 *40-Hour HAZWOPER Training***

All field employees will have completed the OSHA 40-hour HAZWOPER Training in accordance with Title 29 CFR 1926.65(e) and be current with their 8-hour annual refresher course.

### **6.2 *Pre-Entry Briefing***

All personnel working and visiting the Site will read or be briefed to be familiar with the content in the most current version of this HSSE Plan. For documentation purposes, personnel will print their name, sign, and date the HSSE Plan Acknowledgement Page at the beginning of the document. By signing this document, personnel are stating that they have reviewed the HSSE Plan, understand its contents, agree to abide by the requirements, agree that it is in their best interest to see that activities are conducted in the safest manner possible and, therefore, will be alert to Site HSSE conditions at all times. Site contractors will be responsible for briefing their subcontractors and personnel prior to working on the Site.

### **6.3 *Simultaneous Operations Meeting and Site Check-in***

A brief weekly kickoff meeting will be held in the Main Office Building with all on-Site personnel at the start of each week to discuss the upcoming planned work activities and potential SIMOPS issues. On remaining work days, each Site contractor representative will attend a morning SIMOPS meeting to discuss continued coordination efforts and schedule changes. The PIC/SIMOPS Site Lead will be a specific individual as designated on the SIMOPS Meeting Record Form (provided as Appendix B), who has a close working relationship with all Contractor Project Managers/Coordinators and any other on-Site personnel. All Site personnel will check in at the Main Office Building to sign in at the start of the day prior to attending their daily toolbox meeting, and they will sign out at the end of the day stating that their work area is being left in a safe condition and there are no HSSE concerns to report.

### **6.4 *Daily Toolbox Meeting***

Each Site contractor and their subcontractors will carry out daily toolbox meetings attended by all workforce members and be documented. All personnel must understand the scope of work and the hazards and risks identified for that day's activities. Appendix C shows an example form that can be used to document the daily toolbox meeting. Applicable WRAs will be reviewed during the daily toolbox meetings and updated and modified as needed. Completed daily toolbox meeting record forms will be kept on the Site.

## **6.5 *Communication***

No conditions are expected that would render verbal communications difficult or impossible. Hand-held radios may be used on the Site at the discretion of the Site contractors and subcontractors. Site personnel will not use cellular phones while driving/operating equipment and must ensure they are pulled over to a safe stopping place and stopped prior to using them.

## **6.6 *Personal Protective Equipment***

The PPE for the Site will be Level D, unless otherwise noted on WRAs, Standard Operating Procedures, or another subsequent Site documentation. Level D PPE includes high-visibility vest/clothing, safety glasses, hard hat, long pants, long-sleeved work shirt, appropriate gloves, and safety-toed footwear.

## **6.7 *Simultaneous Operations***

Multi-crew operations or SIMOPS that may affect Site personnel will primarily include interaction with other Site contractor and subcontractors. All Contractor Project Managers/Coordinators are responsible for communicating and coordinating all field activities (whether completed by their company or any of their subcontractors) with the PIC/SIMOPS Site Lead. All Site contractors and subcontractors will discuss and document the SIMOPS affecting their work activities during daily SIMOPS and toolbox meetings before starting work.

## **6.8 *Site Work Zones and Traffic Control***

Public access points will be used to access different work areas. The work areas and access points are shown on Figure 2. Decontamination of equipment, if needed, will take place on the Site and the decontamination area(s) will be established by each Site contractor and subcontractor. All decontamination will take place prior to leaving the Site. The exclusion zone (i.e., the areas where work activities will take place) and the support zone (i.e., an area designated to house support personnel and equipment) will also be established by each Site contractor and subcontractor before starting work.

## **6.9 *Decontamination Procedures***

At a minimum, all Site personnel will practice the following decontamination protocol:

- Decontaminate tools and equipment with a water rinse and a soap and water wash.
- Clean footwear and hard hat with a water rinse and a soap and water wash.
- Remove and discard nitrile gloves (if applicable).
- Clean face/hands with soap and water or disposable wipes.

# **7 SECURITY**

Personnel must be aware of the potential for interaction with the public or other contractors and workers who sometimes utilize the area. The Main Office Building will be used as the check in/out point for all Site personnel. Personnel will lock all gates and doors when the facility is not in use and during non-work hours.

## 8 SITE-SPECIFIC EMERGENCY RESPONSE PLAN

To address the most likely emergency response situations at the Site (e.g., personal injuries and/or fires), each Site contractor and subcontractor shall develop an appropriate emergency response plan and be able to carry out support activities outlined therein for the work they will be completing. The following sections describe a general Emergency Response Plan for the Site.

### 8.1 *Emergency Procedure for Accident/Injury*

In case of a serious accident or emergency, personnel will follow the procedure listed below:

1. **Cease Work in the Vicinity:** Notify personnel in the immediate area to stop work and, if applicable, evacuate the area. Notify the person-in-charge of the emergency. Stabilize and lockout equipment, if feasible.
2. **Assess the Situation:** Make sure the scene is safe to enter before further assessing the accident. If conditions are unsafe to enter, do not put yourself or others in danger. Do not move the injured person(s) as this can lead to more severe injuries.
3. **Call 911:** Information to give dispatcher includes the following:
  - Explain the nature of the emergency.
  - Give accurate information on the severity and urgency of the situation.
  - Give clear information on where the accident occurred and the quickest route to get there.
  - If hazardous materials or substances are involved, inform dispatcher of them.
  - When necessary, make follow-up contact with emergency services personnel to provide added information and coordinate response to any injuries of care or service providers.
4. **Escort:** Assign someone to escort emergency personnel to the scene of the accident.
5. **Make Additional Emergency Contacts (as necessary):**

Personnel	Phone Number
Dan Squires – City of Soda Springs Fire Chief	(208) 547-2600
Eric Hobson – Caribou County Emergency Services	(208) 547-2583
Lars Peterson – Multistate Trust Project Manager	(480) 319-3638
Tasha Lewis – Multistate Trust Portfolio Manager	(602) 312-6993
Cindy Brooks – Multistate Trust President/Managing Principal	(617) 448-9762
Joel Gerhart – Pioneer Project Manager	(406) 490-2530
Tara Schleeman – Pioneer Safety and Health Manager	(406) 490-8272
Mark Rhodes – Hydrometrics Project Manager	(406) 431-1637
Steve MacNeil – Tetra Tech Project Manager	(406) 431-1485
Scott Rigby – Tetra Tech Site Caretaker	(208) 221-4340
Heather Halderman – Haley & Aldrich Project Manager	(720) 582-4210
Katherine Cerise – U.S. Environmental Protection Agency	(206) 553-2589
Douglas Tanner – Idaho Department of Environmental Quality	(208) 236-6160

## **8.2 *Emergency Hospital Routes***

The nearest hospital to the Site is the Caribou Memorial Hospital. Information for this hospital includes:

Caribou Memorial Hospital  
300 South 3rd St W  
Soda Springs, ID 83276  
(208) 547-3341

A map illustrating the route to the nearest hospital is provided as Figure 3 of this document.

## **8.3 *Evacuation Procedures***

In case of an emergency, personnel will evacuate to the designated muster point. Site contractors and subcontractor will discuss the location of the day's muster point during their daily toolbox meetings.

## **9 REFERENCES**

DHHS, 2012. NIOSH Pocket Guide to Chemical Hazards. Department of Health and Human Services. June 2012.

GET, 2011. Health and Safety Plan for Kerr-McGee Chemical Superfund Site, Soda Springs, Idaho. Prepared for the Multistate Trust. Global Environmental Technologies LLC. March 25, 2011.

OSHA, 2016. Safety and Health Regulations for Construction. Retrieved from the Occupational Safety and Health Administration website:  
[https://www.osha.gov/pls/oshaweb/owasrch.search\\_form?p\\_doc\\_type=STANDARDS&p\\_toc\\_level=1&p\\_keyvalue=Construction](https://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=1&p_keyvalue=Construction)

## Figures



# KERR-MCGEE CHEMICAL CORP. SODA SPRINGS PLANT SUPERFUND SITE SITE-WIDE HEALTH, SAFETY, SECURITY, AND ENVIRONMENT PROGRAM PLAN



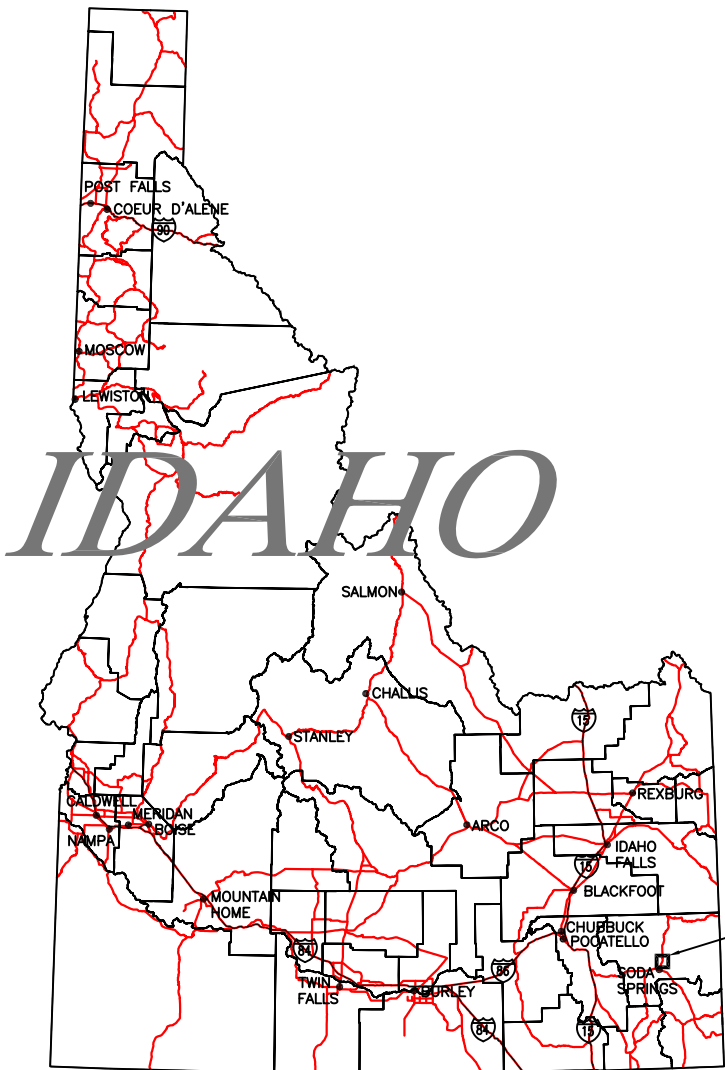
PREPARED FOR  
**GREENFIELD ENVIRONMENTAL MULTISTATE TRUST, LLC**  
**TRUSTEE OF THE MULTISTATE ENVIRONMENTAL RESPONSE TRUST**



PREPARED BY



**MARCH 2018**

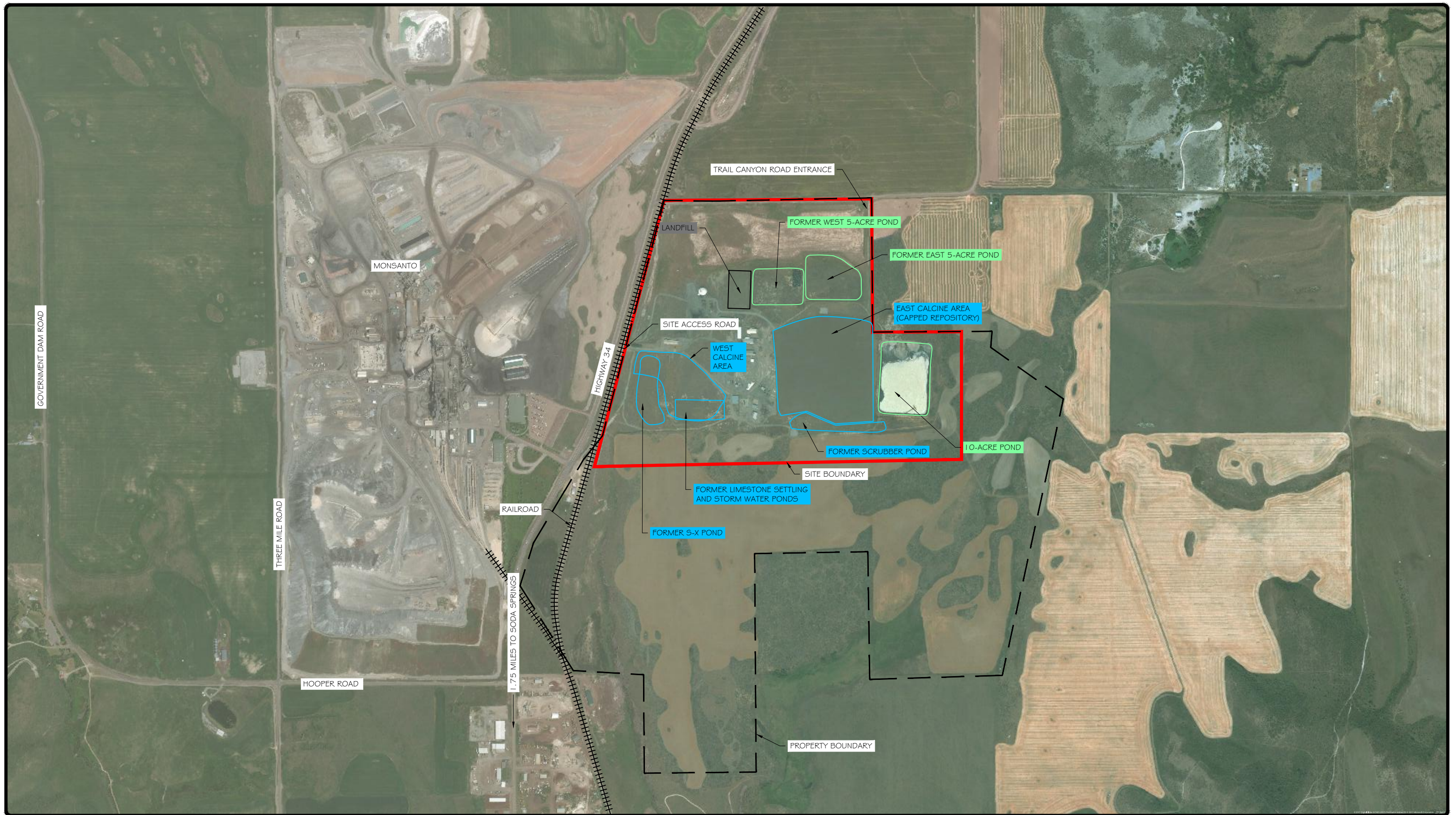


PROJECT  
LOCATION

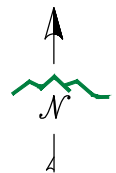


SITE VICINITY MAP





LEGEND:  
— SITE BOUNDARY  
— PROPERTY BOUNDARY  
+ + + + + RAILROAD



DISPLAYED AS:	
COORD SYS/ZONE:	ID83E
DATUM:	NAD 83
UNITS:	FEET
SOURCE:	BING
SCALE IN FEET	
0 500 1000	

FIGURE 2

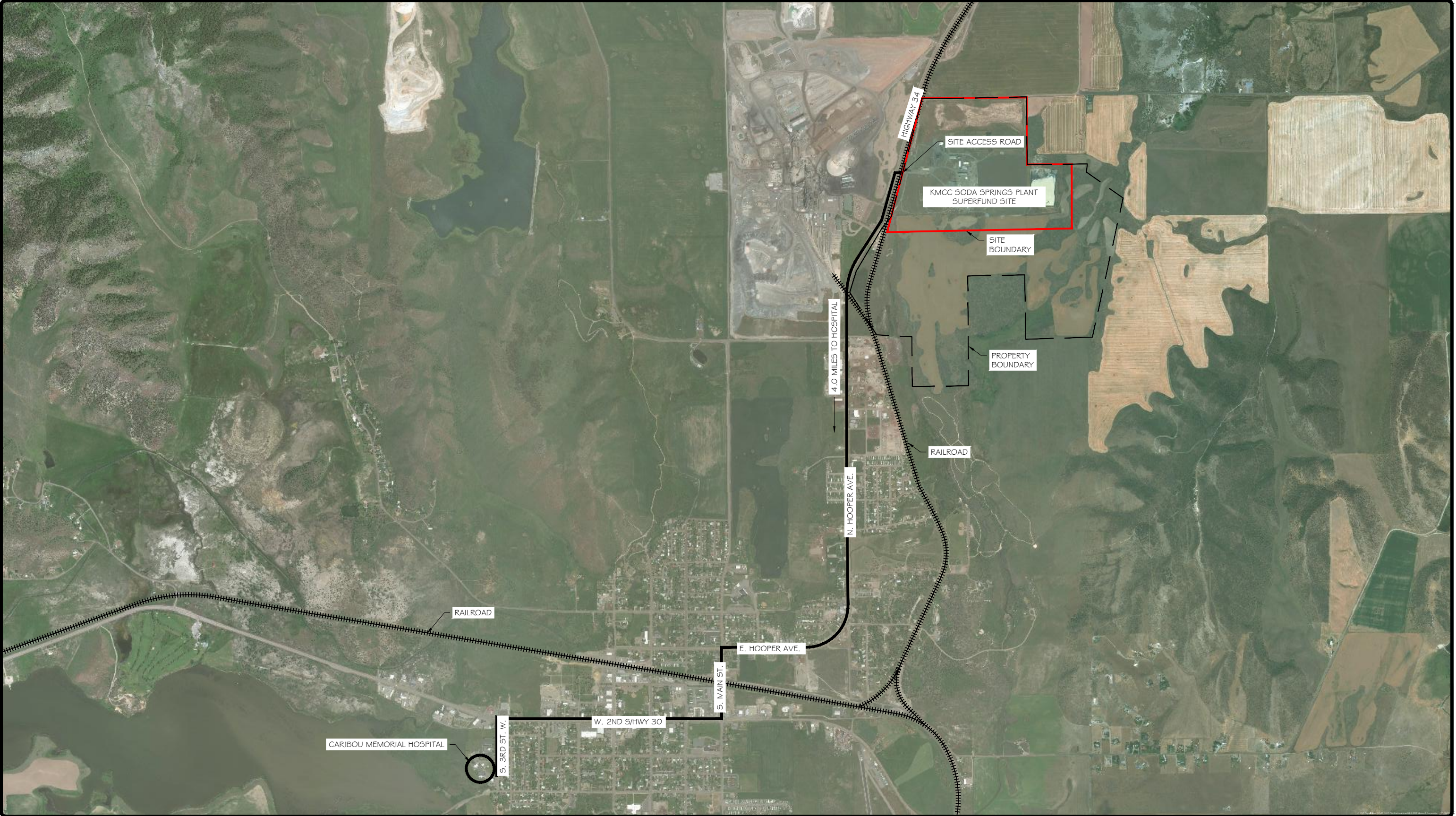
FACILITY SITE MAP



**PIONEER**  
TECHNICAL SERVICES, INC.  
201 E. BROADWAY, SUITE C  
HELENA, MT 59601  
(406) 457-8252

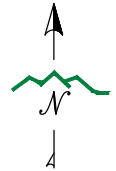
DATE: 02-28-18





LEGEND:

- SITE BOUNDARY
- PROPERTY BOUNDARY
- ++++ RAILROAD
- HOSPITAL ROUTE



COORD SYS/ZONE:	DISPLAYED AS:
DATUM:	ID83E
UNITS:	NAD 83
SOURCE:	FEET
	BING
SCALE IN FEET	
0 500 1000	

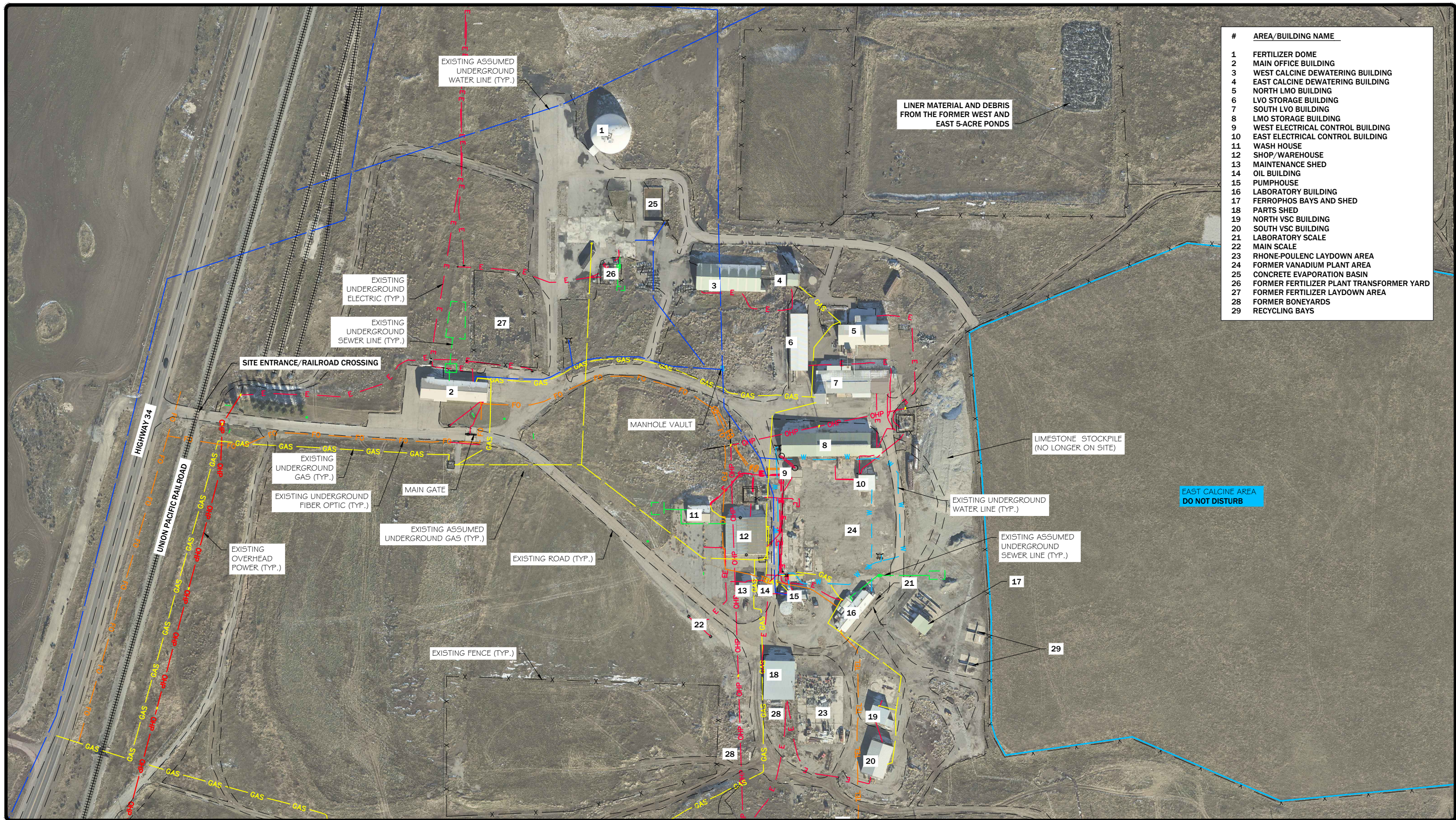
FIGURE 3



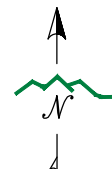
FACILITY LOCATION  
AND HOSPITAL  
ROUTE MAP

DATE: 02-28-18





#	AREA/BUILDING NAME
1	FERTILIZER DOME
2	MAIN OFFICE BUILDING
3	WEST CALCINE DEWATERING BUILDING
4	EAST CALCINE DEWATERING BUILDING
5	NORTH LMO BUILDING
6	LVO STORAGE BUILDING
7	SOUTH LVO BUILDING
8	LMO STORAGE BUILDING
9	WEST ELECTRICAL CONTROL BUILDING
10	EAST ELECTRICAL CONTROL BUILDING
11	WASH HOUSE
12	SHOP/WAREHOUSE
13	MAINTENANCE SHED
14	OIL BUILDING
15	PUMPHOUSE
16	LABORATORY BUILDING
17	FERROPHOS BAYS AND SHED
18	PARTS SHED
19	NORTH VSC BUILDING
20	SOUTH VSC BUILDING
21	LABORATORY SCALE
22	MAIN SCALE
23	RHONE-POULENC LAYDOWN AREA
24	FORMER VANADIUM PLANT AREA
25	CONCRETE EVAPORATION BASIN
26	FORMER FERTILIZER PLANT TRANSFORMER YARD
27	FORMER FERTILIZER LAYDOWN AREA
28	FORMER BONEYARDS
29	RECYCLING BAYS



DISPLAYED AS:
COORD SYS/ZONE: ID83E
DATUM: NAD 83
UNITS: INT. FEET
SOURCE: PIONNER
SCALE IN FEET
0 100 200

FIGURE 4

**PIONEER**  
TECHNICAL SERVICES, INC.  
201 E. BROADWAY, SUITE C  
HELENA, MT 59601  
(406) 457-8252

EXISTING BUILDING  
AND UTILITY  
LOCATIONS

DATE: 02-28-18



## **Appendix A**

### **Project-Level Work Risk Assessment**

Work Risk Assessment

This tool is to be used for pre-project planning.

Date Assessment Completed: 03/02/2018			Project Description: work risk assessment for Site-Wide hazards and risks.	Risk Assessment No.: Multistate Trust, Soda Springs, ID 03/02/2018		
Location: Kerr McGee Chemical Corp. - Soda Springs Plant Superfund Site Greenfield Environmental Multistate Trust Soda Springs, ID				Definitions:		
				Job: A general activity, including several different tasks when working on a project.		
				Task: One of potentially several specific actions that occur as part of the processes to complete an overall job.		
			If SIMOP, Name Person in Charge: Person in Charge/SIMOPS Site Lead and Contractor Project Managers/Coordinators	Hazard: The potential for an uncontrolled release of, or unwanted contact with a biological or an energy source.		

Work Plan  Sequence of Job Steps/Observations List the jobs required to complete the project scope in the sequence they are carried out.	Are any tools or heavy equipment needed for this job?  If YES, What Type of Tools or Equipment?	Is this a SIMOP?  If YES, Include in Mitigation Plan.	Do any of the Golden Rules of Safety apply to any task involved in this job step?  If YES, Which of the 8?	Which of the 8 energy or biological root sources could possibly be involved in this job?  Motion Chemical Biological Gravity Thermal Pressure	What would be the result of exposure to a biological or energy source? (e.g., Bites, Slips, trips, falls, exposures, electrocution, injury, death, etc.); and  How, where, or when could an uncontrolled release or unwanted contact with a biological or energy source occur?  Note: Humans are biological sources, and their physical abilities, competency, and training should also be considered here.	Environmental Impacts  Could there be a release to the air, soil or water, and or, will a waste be generated? If YES, What?	Pre-Mitigation Risk Evaluation				Permit(s) Required?  If YES, What kind?	Energy / Biological / Waste Management Plan  Elimination, Substitution, Isolation, Engineering and Administrative Controls, PPE  Hierarchy of Controls - Risk control measures  List control measures required to eliminate, control, or protect against unwanted contact with an uncontrolled biological or energy source to minimize the risk of injury or environmental Impact.	Who is responsible for Hazard Mitigation?  Write the name of the person responsible to implement the control measure identified.	Post-Mitigation Risk Evaluation			
							Frequency	Consequence	Likelihood	Risk Score				Frequency	Consequence	Likelihood	Risk Score
1. Driving to and from site.	Yes  Vehicle	No	Yes Driving Safety	Motion Chemical Biological Gravity Thermal Pressure	<b>Motion</b> - Bodily injury or possibly death could occur while driving to and from site, due to bad driving conditions (ice, low visibility, driving into the sun, night time driving), distraction or fatigue. Possible interaction with railroad traffic. Collision while backing up causing injury or property damage. <b>Chemical</b> - Dust generation and gasoline while refueling vehicles could cause adverse short-term health effects. Chemical cross contamination due to dirt on boots being transferred into vehicle or other areas. <b>Biological</b> - Injury or death could occur due to operator error, other drivers, animals on the highway, or insects on the windshield. <b>Gravity</b> - Bodily injury from falls when entering and exiting the vehicle. <b>Thermal</b> - Exposure to both heat/cold stresses and dehydration from the climate while in vehicles could cause injury or adverse health effects. <b>Pressure</b> - exposure to tire pressure in event of tire blowout.	Yes  Release of gas, oil, antifreeze or other vehicular fluid. Cross contamination of soil	Continuous Exposure	Very Serious Consequence	Unusual but possible	Very High Risk	No	<b>Motion</b> - Wear seatbelts and practice defensive driving techniques. Do not drive in icy hazardous conditions - postpone work if possible. Obey speed limit. Do not drive if sick or fatigued. Obey traffic controls at railroad crossings. Do not operate vehicle in poor visibility conditions such as blizzards or dust storms. Perform vehicle inspections and clean headlights and windshield before driving. Awareness of changing road conditions due to road closures or construction. <b>Chemical</b> - Limiting exposure near or around idle vehicles. Keep window rolled up while driving and in dust conditions. <b>Biological</b> - Be aware of other drivers. Practice defensive driving techniques. <b>Gravity</b> - Maintain 3-points of contact when entering vehicle, be aware of ground conditions and slippery surfaces. <b>Thermal</b> - Make sure vehicle heater/air conditioning are operating correctly. <b>Pressure</b> - Inspect vehicle tires for bulging prior to driving. Risk Control Action Plan: 1. Car pool whenever possible 2. Limit driving to daylight hours when possible	Contractor Project Managers/ Coordinators	Frequent Exposure	Serious Consequence	Remotely possible	Low Risk
2. Driving on the site.	Yes  Vehicle	No	Yes Driving Safety	Motion Chemical Biological Gravity Thermal Pressure	<b>Motion</b> - Bodily injury or possibly death could occur while driving on the site. Entering and exiting vehicle, icy road conditions, movement from other vehicles and/or equipment. Possible interaction with other traffic. Collision while backing up causing injury or property damage. Possible injury from vehicle getting stuck in mud, or driving too fast on bumpy roads. <b>Chemical</b> - Dust generation could cause adverse short-term health effects. Cross contamination due to contaminated soil on boots. <b>Biological</b> - Interaction with people who may be onsite. Also insect bites could cause allergic reaction or driver distraction and injury while driving. <b>Gravity</b> - Bodily injury from falls when entering and exiting the vehicle. <b>Thermal</b> - Exposure to both heat/cold stresses and dehydration from the climate while in vehicles could cause injury or adverse health effects. <b>Pressure</b> - Exposure to tire pressure in the event of tire blowout.	Yes  Release of gas, oil, antifreeze or other vehicular fluid.	Continuous Exposure	Very Serious Consequence	Unusual but possible	Very High Risk	No	<b>Motion</b> - Wear seatbelts, practice defensive driving techniques, no use of cell phones, no eating while driving on the site, use caution (4-WD) in muddy conditions - postpone work. Follow contractor's traffic control plan and know the traffic pattern. Identify and use safe pull-offs. Use spotter when backing up and turning around, if possible. Do not operate vehicle in poor visibility conditions such as dust storms. Perform vehicle inspections. Stay on roads and designated turnaround areas. Obey speed limits and traffic signage posted on site. Keep windows, headlights and mirrors clean. Maintain a safe distance from haul trucks and heavy equipment. <b>Chemical</b> - Limiting exposure near or around idle vehicles. Keep window rolled up while driving at all times. Follow proper decontamination procedures. <b>Biological</b> - Do not park in tall dry grass that could catch fire. Fire extinguishers should be available in vehicles. Be aware of other construction workers. Practice defensive driving techniques. Honk horn before backing to prevent injury to construction workers. Keep window rolled up while driving at all times to prevent distraction from insects bites. Wear proper PPE to protect against exposure. <b>Gravity</b> - Maintain 3-points of contact when entering vehicle, be aware of ground conditions and slippery surfaces. <b>Thermal</b> - Make sure vehicle heater/air conditioning are operating correctly. <b>Pressure</b> - Inspect vehicle tires prior to driving for bulging.	Contractor Project Managers/ Coordinators	Frequent Exposure	Serious Consequence	Remotely possible	Low Risk
3. Working on the site.	Yes	No	No	Motion Chemical Radiation Electrical Biological Thermal Gravity   SIMOPS	<b>Motion</b> - Walking through/on debris, uneven terrain, and/or muddy surfaces could cause slips and trips. Personnel could be struck by/caught between equipment when walking on the site. Walking while carrying tools and equipment could cause loss of balance and falling. Walking long distances in wet rubber boots could cause blisters. Wind could cause injury from blowing objects and loss of balance. <b>Chemical</b> - Adverse health effects from potential exposure to contaminated soils, vapors, and dust from vehicles and site conditions. Exposure to carbon monoxide from working near active/idling heavy equipment and vehicles. Direct contact with gasoline/diesel when fueling vehicles and equipment could result in skin./eye irritation. Adverse health effects from contact with hydraulic fluid from heavy equipment. <b>Radiation</b> - Exposure to sunlight on site could cause sunburns. Personnel can be exposed to NORM/TENORM via contact with contaminated soils. <b>Electrical</b> - Electrocution or injury from lighting strike/storm or from exposure to old wiring. <b>Biological</b> - On-site plants, small and large animals, and insects (including ticks) could cause physical injury or death and bites/skin irritation. Hornets nests and ant hills could be on the site. <b>Gravity</b> - Injuries from falls resulting from slips and trips when walking on uneven terrain can result in bodily injuries. <b>Thermal</b> - Exposure to both heat/cold stresses, wind and dehydration from the climate and working outdoors in required PPE could cause injury or adverse health effects. Cold stress could occur from getting wet in cold weather. <b>SIMOPS</b> : multi-crew or simultaneous operations (SIMOPS) include interaction with other Site contractors and subcontractors.	No	Continuous Exposure	Very Serious Consequence	Unusual but possible	Very High Risk	No	<b>Motion/Gravity</b> - Wear boots that have proper fit and support as required. Apply first aid at first sign of blisters. Dry boots daily. Be aware of surroundings and footing at all times. Do not talk on cell phones while walking. Watch out for slopes, rocks, holes, slippery spots and areas of deep mud. Establish eye contact with equipment operator before approaching heavy equipment. When possible, maintain a 20-foot buffer zone (or distance mandated by the contractor operating the equipment) around heavy equipment. <b>Chemical</b> - If potential waste material is noticed, avoid contact with soil. Boots and tools will be decontaminated properly when leaving site. Use good hygiene, clean hands before eating. Thoroughly wash hands in potable water or wet wipes. Limit exposure near or around idle vehicles and remain in open to air areas. Stay up wind when possible. Avoid direct contact with gasoline/diesel. Equipment operators will inspect equipment for leaks, wear gloves to prevent contact with hydraulic fluids, and replace/repair faulty lines. <b>Radiation</b> - All personnel will wear required PPE and sunscreen, when necessary. Levels of NORM/TENORM are expected to be nonexistent or low based on history of the operations. <b>Electrical</b> - If there is visible lightning, stop work until storm passes and lightning has not been seen for 30 minutes. <b>Biological</b> - Know the signs and symptoms of exposure to plants and insects bites. Wear proper PPE to protect against exposure. <b>Thermal</b> - Dress appropriately for weather, wear wind resistant clothing in windy conditions, maintain proper hydration, seek shelter in a vehicle in extreme hot or cold conditions, follow established procedure for working in cold/hot temperature extremes as outlined in the Site-Wide HSSE Program Plan. Always carry a cell phone or radio to maintain contact if help is needed. Work trucks will be equipped with a first aid kit and fire extinguisher. <b>SIMOPS</b> - All Site personnel will attend a weekly kickoff meeting to learn about other work activities taking place on the Site and other SIMOPS issues, and follow the SIMOPS procedures as outlined in the Site-Wide HSSE Program Plan.	Contractor Project Managers/ Coordinators	Frequent Exposure	Serious Consequence	Remotely possible	Low Risk

## **Appendix B**

### **SIMOPS Meeting Record Form**

## Kerr-McGee Chemical Corp. – Soda Springs Plant Superfund Site

Date: \_\_\_\_\_

# SIMOPS Meeting Record

SIMOPS Projects: \_\_\_\_\_

Person in Charge/SIMOPS Site Lead: \_\_\_\_\_ Contact: \_\_\_\_\_

SIMOPS Meeting Notes: (All companies on Site – include work activities, locations, interacting tasks, coordination efforts, schedule, etc.):

[illegible]

On-Site Company Contact:

Print Name

Signature

CompanyTelephone/Contact Info[illegible]



## **Appendix C**

### **Example of a Daily Toolbox Meeting Record Form**

Document Control #: \_\_\_\_\_

## DAILY TOOLBOX MEETING RECORD

Page 1 of 2

Job(s) Location(s) \_\_\_\_\_ Date: \_\_\_\_\_

Name of Project Oversight/Project Manager: \_\_\_\_\_ Muster Point: \_\_\_\_\_

Simultaneous Operations (SIMOPs) or Multi-Crew Activity? ☐ Yes ☐ No If yes, describe the SIMOPs: \_\_\_\_\_

SIMOPS communicated to all workers? ☐ Yes ☐ No ☐ N/A If yes, list topics discussed: \_\_\_\_\_

SIMOPs Contacts (Name/Company/#): \_\_\_\_\_

List all jobs to be performed today: \_\_\_\_\_

Safety topic discussion applicable to today's activities: \_\_\_\_\_

Identify if there are any permitted activities and document the permit number: \_\_\_\_\_

Have the hazards for each listed job been identified, assessed, and controlled by a competent person and the workforce on Site? ☐ Yes ☐ No

Have newly identified risks been documented in the Work Risk Assessment (WRA)? ☐ Yes ☐ No ☐ N/A

Have all members of the workforce confirmed understanding of the work scope, hazards, risk controls and mitigation? ☐ Yes ☐ No

Has everyone reviewed the current WRA? ☐ Yes ☐ No

Have equipment checks been completed, documented, and reviewed? ☐ Yes ☐ No ☐ N/A

(Do not proceed unless the answer to all the above questions is Yes or N/A)

Will any conditions change the muster points for today? ☐ Yes ☐ No If yes, describe and discuss with crew: \_\_\_\_\_

### Post Daily Review:

Best practice/activity(s) observed: ☐ Yes ☐ No If Yes, describe them: \_\_\_\_\_

Were there any Incidents or First-Aid Reports for the day? ☐ Yes ☐ No If Yes, name them: \_\_\_\_\_

Were there any 'Stop Work' interventions? ☐ Yes ☐ No If Yes, describe them: \_\_\_\_\_

Area for improvement: Practice/Activity(s) Observed: ☐ Yes ☐ No If Yes, name them: \_\_\_\_\_

**Signature Page****I know the hazards:**

By signing here, you are stating the following:

1. You understand the hazards and risk mitigations in the WRA for each task you are will perform.
2. You understand the permit to work requirements applicable to the work you are about to perform (if it includes permitted activities).
3. You are aware that no tasks or work (that is not risk-assessed) is to be performed.
4. You also are aware of your obligation to **‘Stop Work’** (See *Stop Work Section*).

**I arrived and departed fit for duty:**

5. You are physically and mentally fit for duty.
6. You are not under the influence of any type of medication, drugs, or alcohol that could affect your ability to work safely.
7. You are aware of your responsibility to bring any illness, injury (regardless of where or when it occurred), or fatigue issue you may have to the attention of the Field Team Leader.
8. You signed out uninjured unless you have otherwise informed the Field Team Leader.

**SIMOPs NOTE: SIGNATURES ARE REQUIRED BY ALL PERSONS INVOLVED IN A WORK TASK OR WHO MAY BECOME AFFECTED BY A SIMOP SITUATION.**

Individual Name/Company Name/Signature

Sign in  
timeInitials &  
Sign out  
Time

**I will STOP** the job any time anyone is concerned or uncertain about safety.

**I will STOP** the job if anyone identifies a hazard or additional mitigation not recorded in the WRA.

**I will** be alert to any changes in personnel, conditions at the work site, or hazards not covered by the original WRA.

If it is necessary to **STOP THE JOB**, I will reassess the task, hazards and mitigations; and then amend the WRA as needed.

**Names of Site Visitors not involved in the work activities:**

In: \_\_\_\_\_ Out: \_\_\_\_\_

In: \_\_\_\_\_ Out: \_\_\_\_\_

In: \_\_\_\_\_ Out: \_\_\_\_\_

In: \_\_\_\_\_ Out: \_\_\_\_\_

In: \_\_\_\_\_ Out: \_\_\_\_\_

At the conclusion of the day, I certify that the job site is being left in a safe condition and there were no reports of injury or first aid.

☐ Yes☐ No

Signature of Field Team Leader:

(if no, inform the Project Manager, when applicable)

**Definitions:** **Project** – A planned set of interrelated jobs to be executed over a period of time. **Job** – A general activity, including several different tasks that occur when working on a project. **Task** – One of several potential specific actions that occur as part of the process to complete a job. **Hazard** - The potential for an uncontrolled release of, or unwanted contact with, a biological or energy source.

## **APPENDIX G**

### **CONFIRMATION SAMPLING AND ANALYSIS PLAN**

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**SAMPLING AND ANALYSIS PLAN**  
**CONFIRMATION SOIL SAMPLING OF 10-ACRE POND**  
**KERR-MCGEE CHEMICAL CORP. - SODA SPRINGS PLANT**  
**SUPERFUND SITE**  
**SODA SPRINGS, CARIBOU COUNTY IDAHO**

Prepared for:



**Greenfield Environmental Multistate Trust, LLC**  
Trustee of the Multistate Environmental Response Trust

Prepared by:

**Hydrometrics, Inc.**  
3020 Bozeman Avenue  
Helena, MT 59601

May 2018

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## LIST OF ACRONYMS

%D	Percent Deviations
%R	Percent Recovery
ATSDR	Agency for Toxic Substances and Disease Registry
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	Contaminants of Concern
DEP	Massachusetts Department of Environmental Protection
DQI	Data Quality Indicator(s)
DQO	Data Quality Objective(s)
DU	Decision Unit
EDA	Exploratory Data Analysis
EDD	Electronic Data Deliverables
EPA	Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbon
F	Fahrenheit
FTL	Field Team Leader
GPS	Global Positioning System
HASP	Health and Safety Plan
IC	Institutional Control(s)
ICS	Interference Check Sample
IDEQ	Idaho Department of Environmental Quality
IDW	Investigation-Derived Waste
IS	Incremental Sample(s)
ISM	Incremental Sampling Methodology
KMCC	Kerr-McGee Chemical Corporation
LCS	Laboratory Control Sample(s)
MCL	Maximum Contaminant Level(s)
MDL	Method Detection Limit
MS	Matrix Spike(s)
MSD	Matrix Spike Duplicate(s)
Multistate Trust	Greenfield Environmental Multistate Trust, LLC, Trustee of the Multistate Environmental Response Trust
µg/L	Microgram per Liter
mg/kg	Milligram per Kilogram
NDs	Nondetects
NPL	National Priorities List
PC	Percent Complete
PM	Project Manager(s)
PPE	Personal Protective Equipment
PSLs	Project Screening Levels
QA/QC	Quality Assurance/Quality Control
RAWP	Removal Action Work Plan
RBPS	Risk-Based Groundwater Performance Standards
RI	Remedial Investigation
RLs	Reporting Limits
ROD	Record of Decision

RPD	Relative Percent Difference
RSL	Regional Screening Level(s)
SAP	Sampling and Analysis Plan
Site	Kerr-McGee Chemical Corporation – Soda Springs Plant Superfund Site, Soda Springs, Caribou County, Idaho
SOP	Standard Operating Procedure(s)
SRI	Supplemental Remedial Investigation
SSL	Soil Screening Level
SU	Sampling Unit(s)
TBP	Tributyl Phosphate
TCRA	Time-Critical Removal Action
TPH	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit

**SAMPLING AND ANALYSIS PLAN**  
**CONFIRMATION SOIL SAMPLING OF 10-ACRE POND**  
**KERR-MCGEE CHEMICAL CORP. - SODA SPRINGS PLANT**  
**SUPERFUND SITE**  
**SODA SPRINGS, CARIBOU COUNTY IDAHO**

**1.0 INTRODUCTION**

This Sampling and Analysis Plan (SAP) specifies the methods and procedures to be used for collecting and analyzing soil samples during post-removal soil confirmation sampling of the Time-Critical Removal Action (TCRA) for the 10-Acre Pond at the Kerr-McGee Chemical Corporation (KMCC) – Soda Springs Plant Superfund Site, Soda Springs, Caribou County, Idaho (Site). This SAP was prepared on behalf of the Greenfield Environmental Multistate Trust, LLC, Trustee of the Multistate Environmental Response Trust (Multistate Trust), in support of ongoing environmental investigation and restoration activities at the Site. This SAP supports the Environmental Actions performed by the Multistate Trust as approved by and under the oversight of the U.S. Environmental Protection Agency (EPA), as Lead Agency for the Site, in consultation with the Idaho Department of Environmental Quality (IDEQ), as the Non-Lead Agency for the Site. The Multistate Trust's objectives are to ensure that the Site conditions are understood and appropriate actions are taken to protect human health and the environment. The TCRA will be performed by the Multistate Trust, and its contractors, in accordance with Section 104 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA).

**1.1 PROJECT ORGANIZATION**

Key project individuals for the post-removal 10-Acre Pond TCRA confirmation soil sampling and their responsibilities are listed below.

- Multistate Trust
  - Cindy Brooks: Managing Principal
  - Tasha Lewis: Portfolio/Program Manager
  - Lars Peterson: Project Manager
- EPA
  - Kathryn Cerise: Remedial Project Manager

- IDEQ
  - Dean Nygaard: Remedial Program Manager
  - Doug Tanner: Regional Project Manager
  - Stan Christensen: Site Project Manager
- Hydrometrics, Inc.
  - Mark Rhodes: Project Manager
  - Mark Walker: Project QA Manager
  - Caitlin Walter: Project Oversight

## **1.2 PROJECT SCHEDULE**

The schedule for planning document preparation, pond removal, confirmation sampling, data review, and preparation of final deliverables will conform to the following:

1. Implementation of the TCRA will be initiated within 45 days after EPA approval of the 10-Acre Pond Removal Action Work Plan (RAWP).
2. At this time, it is anticipated that pond removal and associated activities will be conducted from approximately June through November 2018.
3. Confirmation sampling will be conducted following the removal and prior to reclamation. At this time, confirmation sampling is anticipated to occur in September 2018.
4. Laboratory analysis and reporting is expected to be completed within 25 days after receiving samples, with the laboratory providing a Level 4 data package.
5. Data validation for confirmation sampling will be completed within 45 days of receipt of the final analytical data package from the laboratory.
6. A Draft Removal Action Completion Report will be submitted within 60 days of completing data validation.
7. A Final Removal Action Completion Report will be submitted within 30 days of receiving EPA's comments on the Draft Report.

## **1.3 DISTRIBUTION LIST**

A copy of the approved SAP for this investigation will be provided via email (electronic copy) and/or regular mail or hand delivery (compact disc or hard copy report) to the following individuals:

- Cindy Brooks (Multistate Trust);
- Tasha Lewis (Multistate Trust);
- Lars Peterson (Multistate Trust);
- Kathryn Cerise (EPA);
- Dean Nygard (IDEQ);

- Doug Tanner (IDEQ);
- Stan Christensen (IDEQ);
- Mark Rhodes (Hydrometrics);
- Mark Walker (Hydrometrics); and
- Caitlin Walter (Hydrometrics).

#### **1.4 SAMPLING AND ANALYSIS PLAN ORGANIZATION**

This SAP describes the procedures and tasks necessary to complete post-removal confirmation soil sampling of the 10-Acre Pond TCRA throughout the following sections:

- Background (2.0);
- Project Data Quality Objectives (3.0);
- Sampling Rationale (4.0);
- Method and Procedures (5.0);
- Data Evaluation (6.0);
- Corrective Action (7.0);
- Field Health and Safety Procedures (8.0); and
- References (9.0).

## **2.0 BACKGROUND**

KMCC operated a vanadium production facility at the Site from 1963 to 1999. As part of operations during this period, KMCC stored production process water and waste in several unlined ponds. From 1981 to 1989, significant uncontrolled releases of contaminated water occurred from the ponds to groundwater. On October, 4, 1989, EPA listed the Site on the National Priorities List (NPL) as a result of the releases.

### **2.1 SITE DESCRIPTION**

The Site is located in Caribou County, Idaho, approximately 1.5 miles north of Soda Springs (Figure 2-1). The approximately 538-acre Site is bordered by agricultural lands to the north, east, and south and by State Route 34 on the west. A phosphate processing plant (Monsanto facility) borders the west side of State Route 34, adjacent to the Site. With the exception of the Monsanto facility, the Site is bordered by rural areas within a 1-mile perimeter. The footprint of the proposed confirmation sampling at the 10-Acre Pond is shown in Figure 2-2.

The Site consists of six parcels of land, with 18 buildings currently remaining on-Site, many of which are not structurally sound or salvageable and are scheduled for demolition in 2018. Other than the remaining buildings, the 10-Acre Pond is the only remaining feature from the historical operations.

The Site elevation ranges 5,900 to 6,020 feet above sea level with average temperatures ranging from 29 to 55 degrees Fahrenheit (F). The wet season for the area is between March and June, with an annual average rainfall of approximately 15.9 inches. Wind rose data from Allen H. Tigert Airport (located about 2.5 miles south of the Site) show the predominant wind direction to the southeast.

There are six springs near the 10-Acre Pond that serve as the municipal water supply for the City of Soda Springs. One spring, Formation Spring, is located 1.5 miles northeast of the pond, and five springs are present in the Kelly Park area, located approximately 1.5 miles south of the 10-Acre Pond.

### **2.2 OPERATIONAL HISTORY**

KMCC (later Tronox Chemical Corporation) owned and operated the Site as a chemical manufacturing facility from 1963 through 2009. The facility produced vanadium from 1963 to 1999 and other secondary by-products such as fertilizer and cathode materials for rechargeable batteries in the later years of operation. Over the course of the operational history, both lined and unlined ponds were incorporated for settlement, solvent extraction



AERIAL IMAGER SOURCE: 2017 GOOGLE EARTH IMAGE DATE: 7/19/2016



PREPARED FOR:  
GREENFIELD ENVIRONMENTAL  
MULTISTATE TRUST, LLC,  
TRUSTEE OF THE MULTISTATE  
RESPONSE TRUST

## LOCATION MAP

FIGURE

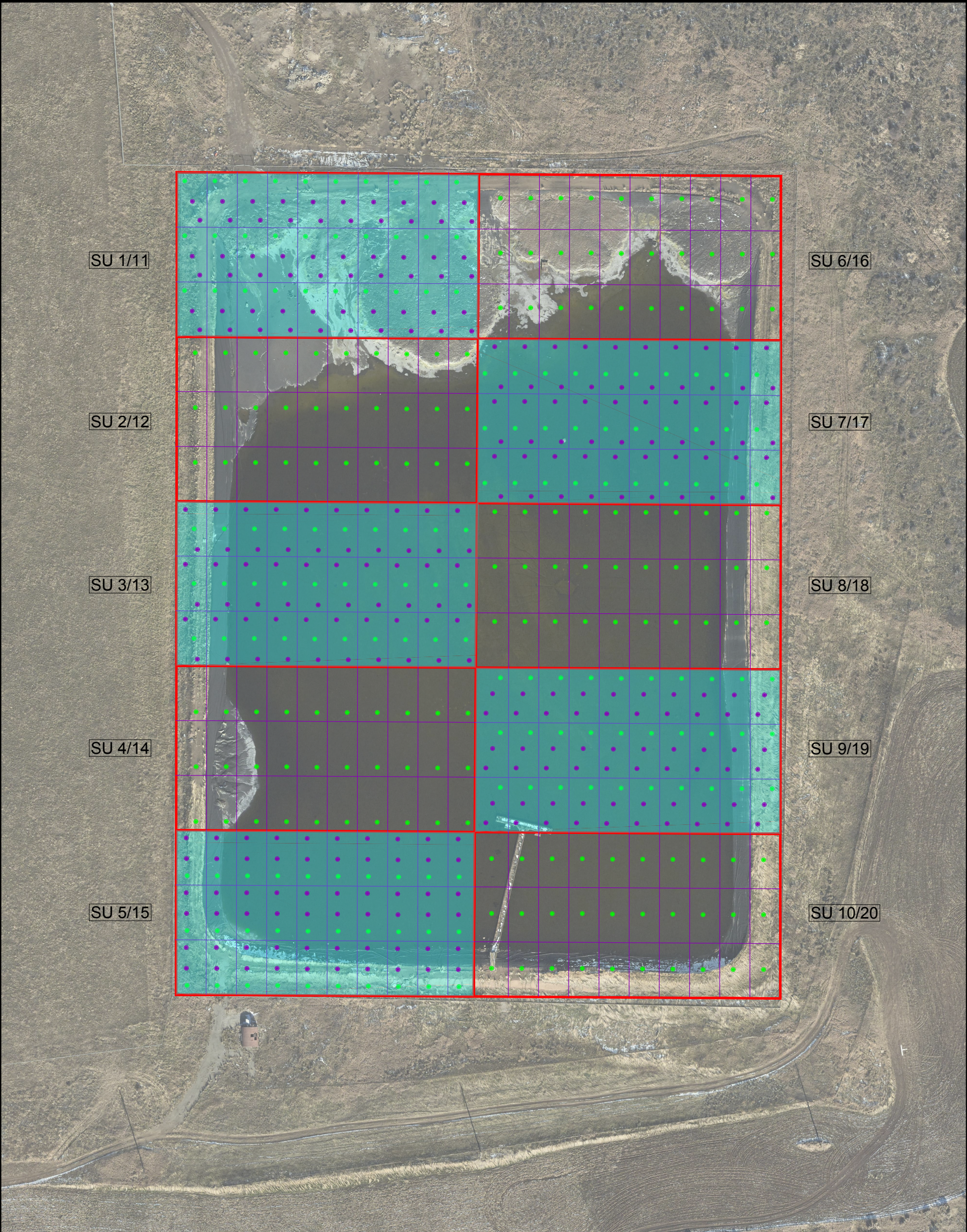
2-1

UPDATE TIME: 4:48 PM

MRHODES\HEL\20171109\F:\DROPBOX\SODA SPRINGS MULTISTATE TRUST SITE\TCAM 10 ACRE POND\FIGURES.DWG

**Hydrometrics, Inc.**  
Consulting Scientists and Engineers

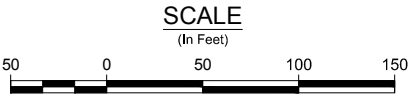
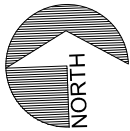




LEGEND

- SAMPLE UNIT
- SAMPLE UNIT ID
- SAMPLE GRID
- SU COMPOSITE SAMPLE POINT, SURFACE (0-6 INCHES) AND SUBSURFACE (6-12 INCHES)
- SU TRIPPLICATE SAMPLES WILL BE COLLECTED
- SU TRIPPLICATE SAMPLE LOCATION, SURFACE (0-6 INCHES) AND SUBSURFACE (6-12 INCHES)

10-ACRE POND  
SCALE:1"=100'





raffinate, tailings storage, product storage, and storm water retention. In 1997, KMCC constructed the 10-Acre Pond to contain liquids and solids from the closure of three on-Site ponds and from vanadium processing. In 2004, water and sediment from the closure of two additional 5-acre ponds were added to the 10-Acre Pond.

## **2.3 PREVIOUS INVESTIGATIONS AND REGULATORY HISTORY**

The timeline for investigations and regulatory history at the Site can be summarized as follows, with specific details provided in the 2017 Draft Phase I and Phase II Supplemental Remedial Investigation (SRI) Report (Tetra Tech, 2017), and in this RAWP:

- 1979: Initial discovery of environmental problems at the Site.
- 1981 and 1989: Significant failures in the ponds resulting in contaminated process water lost to vadose zone.
- 1985: Preliminary Assessment and Site Investigation performed by the State of Idaho Hazardous Materials Bureau, identifying the Site as a potential source of groundwater contamination.
- 1988: Site investigation under CERCLA.
- 1989: Site listed on the NPL.
- 1991 to 1994: Remedial Investigation (RI) under EPA oversight conducted, identifying groundwater as media of concern and the primary route of exposure as ingestion of groundwater. Identified contaminants of concern (COCs) include vanadium, molybdenum, manganese, tributyl phosphate (TBP), and total petroleum hydrocarbons (TPH) in excess of project screening levels (PSLs) (equivalent to the risk-based groundwater performance standards (RBPS) outlined in the Record of Decision (ROD) and arsenic in excess of the maximum contaminant level (MCL)). A secondary concern identified during the RI was potential ingestion and direct contact risk from elevated vanadium in material associated with the roaster reject area.
- 1995: ROD issued for non-operational portions of the Site with the following presented remedies:
  1. Eliminating uncontrolled liquid releases by replacing unlined ponds with lined ponds;
  2. Reuse and/or recycling of buried calcine tailings in fertilizer manufacturing at the Site over an 8-year period;
  3. Closure of select ponds and disposal of pond solids in an on-Site landfill;
  4. Capping of 'wind-blown' calcine and roaster reject material;
  5. Initiation of semi-annual groundwater monitoring program to monitor effectiveness of control measures in achieving groundwater PSLs for the COCs; and
  6. Incorporation of institutional controls (ICs) for off-Site exposure to groundwater for as long as PSLs are exceeded.

- 1997: Consent Decree implementing required remedy entered by the court targeting remedial actions for groundwater, roaster reject, and windblown calcine.
- 2000: ROD addendum changing reuse/recovery of calcine solids to capping after EPA concluded that the fertilizer plant could not meet ROD-specified timeframe.
- 2005/2006: KMCC divested and transfers Site to Tronox Chemical Corporation.
- 2009: Tronox filed for Chapter 11 bankruptcy.
- 2011: Bankruptcy court approved the Consent Decree and Environmental Settlement with the United States, 24 States, and Tronox resulting in the Site transfer to Multistate Trust.
- 2002, 2007, 2012, and 2017: Five-year reviews conducted by EPA. Results reflect that remedy for the Site conducted in accordance with ROD do not yet currently protect human health and the environment. Eight actions were identified in the 2012 review that needed to be taken at the Site, including:
  1. Delineate additional potential sources of Site-related COCs within former KMCC facility (noted as ongoing in the 2017 five-year review).
  2. Establish proprietary controls for the Site (noted as ongoing in the 2017 five-year review).
  3. Develop and implement IC plan governing groundwater use downgradient of the Site where COCs are known to exceed MCLs or RBPS (noted as ongoing in the 2017 five-year review).
  4. Investigate current and potential future uses and proximity of domestic wells in relation to the groundwater plume or plumes downgradient from the Site (noted as completed in the 2017 five-year review).
  5. Augment and expand groundwater well network to more fully delineate plumes (noted as ongoing in the 2017 five-year review).
  6. Conduct fence repair at Site to improve IC at landfill and calcine caps (noted as completed in the 2017 five-year review).
  7. Develop and implement a Site wide Operations and Maintenance Program (noted as completed in the 2017 five-year review).
  8. Conduct risk assessment of ecological receptors downgradient from the Site (noted as ongoing in the 2017 five-year review).

Recommendations in the 2017 five-year review include:

1. Finalize draft screening level assessment, identify data gaps, and complete characterization of source material in 10-Acre Pond.
  2. Develop and implement an IC Plan governing groundwater use at downgradient locations where COCs exceed MCLs or RBPS.
  3. Finalize multi-phased SRI.
- 2014: The Multistate Trust mitigated fugitive dust emissions at the 10-Acre Pond by regrading the pond beach area and applying dust and erosion control agents to the surface solids.

- 2015: The Multistate Trust initiated an SRI after receiving the Anadarko Litigation Settlement funds. The SRI is currently ongoing and has the following objectives:
  1. Investigate the possibility of additional sources of Site-related COCs and characterize if necessary;
  2. Augment and expand groundwater monitoring network;
  3. Improve delineation of molybdenum and vanadium contaminant plumes, local groundwater gradients, and anthropogenic influences on area-wide groundwater;
  4. Perform investigation to determine if Site-related COCs are impacting City of Soda Springs drinking water sources;
  5. Update Baseline Human Health and Ecological Risk Assessments by collecting new data; and
  6. Support Focused Feasibility Study by collecting new data.

## **2.4 ENVIRONMENTAL AND HUMAN IMPACT**

The Site COCs molybdenum, vanadium, manganese, arsenic, TPH, and TBP have been identified at the Site by the ROD (EPA, 1995). It is currently unknown if the liner in the 10-Acre Pond has been compromised, and there is potential that the COCs have migrated to underlying soils and shallow groundwater.

Potential releases of COCs from the Site present a significant potential risk to both human and ecological receptors as aqueous concentrations in the 10-Acre Pond surface water exceed PSLs for Site groundwater by several orders of magnitude, with observed concentrations of up to 253,000 µg/L molybdenum (compared with a PSL of 180 µg/L); 32,000 µg/L vanadium (PSL of 260 µg/L); and 11,700 µg/L manganese (PSL of 180 µg/L). Potential release mechanisms at the pond include leaching and percolation/infiltration of COCs into underlying soil and shallow groundwater, discharge of COCs from shallow groundwater to surface water (downgradient springs), and windblown dispersion of COCs from seasonally dry areas within the pond area footprint off-Site.

Potential exposure pathways to both human and ecological receptors that have been identified include the following:

- Exposure of biological receptors to COCs in the 10-Acre Pond water and sediment;
- Exposure of biological receptors in springs/ponds/creeks impacted by off-Site COCs;
- Incidental ingestion and dermal contact of off-Site COCs in springs/ponds/creeks by recreational human receptors;
- Ingestion of fish that have bioaccumulated COCs in springs/ponds/creeks by recreational human receptors;

- Ingestion of waterfowl that have bioaccumulated COCs in springs/ponds/creeks by recreational human receptors;
- Ingestion of off-Site COCs in drinking water sources by human receptors; and
- Incidental ingestion and dermal contact of on-Site COCs in springs/ponds/creeks by trespassing human receptors.

Pursuant to Section 104 of the CERCLA Endangerment Determination, actual or threatened releases of hazardous substances from the 10-Acre Pond, if not addressed by implementing the proposed response action selected in the TCRA Action Memorandum (EPA, 2017a) and detailed in this RAWP, may present an imminent and substantial endangerment to public health or welfare, or the environment.

### **3.0 PROJECT DATA QUALITY OBJECTIVES**

The EPA Data Quality Objective (DQO) process is the agency-recommended planning process when environmental data will be used to derive an estimate of contamination (EPA, 2006). The recommended DQO process consists of seven steps that are used to develop performance and acceptance criteria that clarify study objectives, define the appropriate types of data, and specify tolerance of decision errors that will ultimately be used as the basis for establishing the quality and quantity of data needed to support decisions. These steps are outlined below for confirmation soil sampling proposed following the 10-Acre Pond TCRA for this Site, and are summarized in Table 3-1.

#### **3.1 STEP 1: STATE THE PROBLEM**

Historical operation of a vanadium production facility at the Site has resulted in consolidation of contaminated wastes in a 10-Acre Pond. The Site COCs that have been identified in the pond include arsenic, manganese, molybdenum, vanadium, diesel range TPH, and TBP. Contaminated surface soils around the property may leach into near surface soils and shallow groundwater or be blown to adjacent land on and off the Site property. Observations of tears in the 10-Acre Pond liner suggest that subsurface soil and potentially groundwater may be impacted by leaching from contaminated material within the pond. As part of the TCRA described in this RAWP, the 10-Acre Pond will be dewatered, dredged, the liner removed, and 1-foot of soil removed below the pond. The concentration and distribution of Site-related COCs in soil beneath the pond 10-Acre Pond is currently unknown. At the request of EPA and IDEQ, confirmation soil sampling will be conducted on the 10-Acre Pond TCRA footprint following the removal using relevant Incremental Sampling Methodology (ISM) guidance (ITRC, 2012) for sample collection, to allow accurate characterization of COC concentrations remaining in soils after the removal is completed.

#### **3.2 STEP 2: IDENTIFY THE GOALS OF THE STUDY**

Collect adequate data to characterize Site COC concentrations in surface (0-6 inches) and subsurface (6-12 inches) soils within the former pond footprint following removal of the 10-Acre Pond to allow comparison to applicable PSLs (Tetra Tech, 2017) and EPA Regional Screening Levels (RSLs) for (1) Composite Worker Soils (EPA, 2017b) and (2) Protection of Groundwater (EPA, 2017c).

TABLE 3-1. 10-ACRE POND CONFIRMATION SOIL SAMPLING DATA QUALITY OBJECTIVES SUMMARY  
Former Tronox/Kerr-McGee Chemical Corporation Superfund Site  
Soda Springs, Idaho

State the Problem (Step 1)	Goals of the Study (Step 2)	Information Input and Boundaries (Steps 3 and 4)	Analytical Approach and Decision Rules (Steps 5 and 6)	Optimizing Design for Obtaining Data (Step 7)
The concentration and distribution of Site-related COCs in soil beneath the excavation limit of the 10-Acre Pond TCRA footprint is currently unknown.	Collect adequate data to evaluate COC concentrations in surface (0-6 inches) and subsurface soils (6-12 inches) post-excavation, relative to applicable PSLs and RSLs.	<p>The 10-Acre Pond TCRA footprint is a single Decision Unit and has been divided into 20 SUs, 10 of which are in the surface soil layer and 10 in a subsurface layer.</p> <p>Incremental Sampling Methodology will be used to conduct soil sampling. Incremental Samples for soil will be collected from each SU using a systematic random grid pattern at a target frequency of 30 samples per SU. Layout of the Incremental Samples will depend on excavation bottom conditions, such as the presence of bedrock (no soil present) or unknown obstructions.</p> <p>Field triplicate samples will be collected at 10 of the SUs (five for surface soils and five for subsurface soils) as shown in Figure 2-2.</p> <p>Within each SU, each ISM sample (consisting of 30 subsamples) will be composited and sent to the laboratory for processing. The composite soil samples will be analyzed for arsenic, manganese, molybdenum, vanadium, tributyl phosphate, and EPH fractions (using Massachusetts DEP EPH Method to characterize the diesel-range carbon fractions potentially present in soil fractions generally comparable to EPA RSLs).</p>	<p>Arsenic, manganese, molybdenum, vanadium will be analyzed using the EPA 3050B and EPA 6020 Methods. Tributyl phosphate will be analyzed by the EPA 8141A Method. The EPH diesel-range carbon fractions will be analyzed using the Massachusetts DEP EPH 1.1 Method. PAH targets will be analyzed using EPA 8270C/D, 625 SIM.</p> <p>Decision rules for samples submitted for laboratory analysis include:</p> <p>1) Data will undergo data validation protocols: 10 percent Level 4 and 90 percent Level 2a.</p> <p>2) Precision: Lab and field duplicate RPD =&lt; 35%.</p> <p>3) Accuracy: Matrix spike sample recovery within the range of 75% to 125%, laboratory control spike samples within the range of 80% to 100%, or within the 95% confidence limit of the known value.</p> <p>4) Completeness: 100% for sampling, 95% for data completeness.</p> <p>5) Comparability: Conventional analysis methodologies are consistent with laboratory protocol.</p> <p>6) Representativeness: Collection of 30-point Incremental Samples (to be composited) per SU, which may be adjusted if bedrock is present.</p> <p>7) The Laboratory Reporting Limit shall be equal to or less than the screening criteria. If the RL exceeds the screening criteria, the Method Detection Limit shall be equal to or less than the screening criteria, if practicable.</p> <p>Statistical analysis of the validated dataset will be conducted using EPA’s ProUCL software, and/or other software as needed. Appropriate statistical approaches will be discussed with EPA/IDEQ after the datasets for constituents of interest have been characterized.</p> <p>Data from the confirmation sampling within the 10-Acre Pond TCRA footprint will be evaluated in the risk assessment and feasibility study, where it will be determined if additional actions are required.</p>	<p>If bedrock is present over less than 75% of a SU, the systematic random grid will be adjusted accordingly to collect 30 subsamples from the area where sufficient soil is present to allow sampling.</p> <p>If bedrock is present over 75% (or greater) of a SU, the remaining soil area will be added to an adjacent Sampling Unit at the discretion of the field team leader and project manager.</p> <p>If decision rules are not met for a SU, then corrective action may be implemented, potentially including additional ISM soil sampling.</p>

**Notes and Abbreviations:**  
% = percent  
COC = Contaminant of Concern  
DEP = Department of Environmental Protection  
EPH = Extractable Petroleum Hydrocarbon  
EPA = Environmental Protection Agency  
IDEQ = Idaho Department of Environmental Quality

PSL = Project Screening Level  
RPD = Relative Percent Difference  
RSL = Regional Screening Level  
SU = Sampling Unit  
TCRA = Time Critical Removal Action

### **3.3 STEP 3: IDENTIFY INFORMATION INPUTS**

The information input needs related to the project goals include:

- The 10-Acre Pond TCRA footprint is considered a single decision unit (DU) for this investigation and has been divided into 20 sampling units (SUs), 10 of which are in the surface soil layer (0-6 inches) and 10 in a subsurface layer (6-12 inches).

Incremental samples (IS) for soil will be collected from each SU as described Sections 4.1 and 5.3 and will be analyzed for COCs as described in Section 5.8, to determine concentrations of COCs within each SU (i.e., spatial variability of COC concentrations beneath the 10-Acre Pond) and within the DU as a whole, for subsequent comparison to relevant standards (i.e., PSLs and EPA RSLs).

### **3.4 STEP 4: DEFINE THE BOUNDARIES OF THE STUDY**

Spatial boundaries of the study are defined based on the target populations of interest, which have been divided into 20 SUs within a single DU. The 10-Acre Pond post removal footprint has the potential to have been impacted by contamination of COCs stored in the pond. Considering that hot spots may be located in zones beneath areas where the liner has been compromised, the 10-Acre Pond has been divided into 1-acre plots, to help delineate smaller areas that may be elevated in Site COCs within the larger pond footprint. Thus, the overall DU (complete pond area) has been broken up into a 5 x 2 grid, with a surface layer (0-6 inches, 10 SUs) and a subsurface layer (6-12 inches, 10 additional SUs) within each 1-acre area (Figure 2-2). There is a possibility that bedrock will be exposed within the post-removal 10-Acre Pond TCRA excavation footprint. If an SU is more than 75 percent bedrock, then any surface soil within the SU will be included in adjacent SUs.

### **3.5 STEP 5: DEVELOP THE ANALYTIC APPROACH**

COC concentrations will be determined analytically for each of the ISs representing SUs within the 10-Acre Pond DU. Composite samples collected using ISM are designed to facilitate representative and accurate estimation of the average contaminant concentration within an SU or DU via a structured composite sampling and processing protocol, that reduces data variability and provides a reasonably unbiased estimate of mean contaminant concentrations (ITRC, 2012). The ISM approach includes recommendations for collecting a minimum of 30 subsamples of equal volume to obtain a representative composite sample within a given SU. ISM also recommends collecting three or more replicates (triplicates) within SUs to determine variability, and to aid in calculating statistics such as a 95% Upper Confidence Limit (UCL) on the mean. Triplicate ISM samples will be collected from 50% of the proposed SUs to evaluate Site soil heterogeneity. ISM triplicates will not be used for

evaluating field or laboratory precision, as they will be collected from different locations within a single SU and will be used to evaluate soil heterogeneity (see Section 3.6.2.1).

The EPA RSLs do not specifically target diesel range TPH, but instead targets low, medium, and high carbon content fraction ranges for both aliphatics and aromatics. Based on historic process use of No. 2 diesel, the TPH fractions of concern at the Site consist of diesel-range organics, however, EPA RSLs are specific to TPH carbon fractions (low C5-C8, medium C9-C18, and high C19-C32 aliphatics; low C6-C8, medium C9-C16, and high C17-C32 aromatics). Although fuel compositions may vary depending on the source of crude oil and the refining process, diesel range organics predominantly fall within the carbon ranges medium to high aliphatics (C9-C19+) and medium to high aromatics (C9-C12+), with minor fractions of lighter components (Brewer et al., 2013). The Agency for Toxic Substances and Disease Registry (ATSDR) notes that diesel fuels “predominantly contain a mixture of C10-C19 hydrocarbons” (ATSDR, 1999). In order to provide a general characterization of the diesel-range carbon fractions potentially present in soils, samples will be analyzed for Extractable Petroleum Hydrocarbon (EPH) fractions using the Massachusetts Department of Environmental Protection (DEP) EPH Method, which includes the C9-C18 aliphatics, C19-C36 aliphatics, and C11-C22 aromatics fractions. This approach will facilitate a relative comparison of TPH concentrations to EPA RSLs for the medium aliphatic (C9-C18 aliphatic), high aliphatic (C19-C32 aliphatic) medium aromatic (C9-C16 aromatic) and high aromatic (C17-C32 aromatic) carbon fractions. To further supplement the evaluation of diesel range organics, polycyclic aromatic hydrocarbon (PAH) target compounds are included in the analysis (Table 5-2). PAH results will be compared to EPA RSL.

Composite soil samples will be combined into a single sample container (i.e., HDPE wide-mouth jar) on Site, and shipped to the analytical laboratory for further processing and analysis of total arsenic, manganese, molybdenum, vanadium, EPH carbon fractions, PAH target compounds, and TBP. Laboratory processing and analysis is described in Section 5.8.

Data from the confirmation sampling within the 10-Acre Pond TCRA footprint will be evaluated in the risk assessment and feasibility study, where it will be determined if additional actions are required for the area.

## **3.6 STEP 6: SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA**

### **3.6.1 Confirmation Soil Sampling Performance Standards**

Accurate, precise, representative data are required for sample results to meet the project objectives of determining in-place post-removal soil concentrations to support future decision making. The post-removal soil concentrations within the 10-Acre Pond TCRA footprint will be compared to EPA RSLs for composite worker soil (EPA, 2017b) and protection of groundwater (EPA, 2017c). In addition, summary statistics may be calculated using soil



concentrations for individual SUs and for the DU as a whole, including 95% UCL calculations or other statistics as appropriate. The RSLs and reporting limits (RLs) for soils at the Site are specified in Table 5-2. The laboratory RLs shall be equal to or less than the RSLs. If the RL exceeds the RSL, the Method Detection Limit (MDL) shall be equal to or less than the RSL, if practicable. With the current available methods for this sampling event, the RL and MDL for TBP and EPH C11-C22 are slightly above the EPA groundwater protection RSLs (Table 5-2). However, there has yet to be any observed organic impacts to groundwater off-site or within the vicinity of the 10-Acre Pond, and impacts of slightly elevated RLs from the groundwater protection RSLs are expected to be minimal. The incorporation of PAH targets will also help reduce the uncertainty of EPH RSL exceedances. All laboratory analysis will be performed by Pace Analytical Laboratory. Data must meet the DQOs that have been specified for the parameters in this SAP.

### **3.6.2 Data Quality Indicators and Measurement Quality Objectives**

Quality Assurance/Quality Control (QA/QC) practices and analytical methods for this project have been designed to produce data of sufficient quality to support the intended data uses. Data quality will be assured by adherence to the methods and procedures outlined in this SAP, including full documentation of all field activities; specification and use of appropriate analytical methods; collection, analysis, and review of appropriate field and laboratory quality control samples; review of laboratory reports; verification and validation of analytical data (10 percent Level 4 and 90 percent Level 2b: see Section 6.1); and adequate design of the sampling plan. Each of these data quality indicator (DQI) elements is discussed in subsequent sections of this document.

Data assessment criteria for specific DQIs will be used to aid in the evaluation of overall data quality for data generated during the 10-Acre Pond TCRA. These DQIs are expressed in terms of precision, accuracy, representativeness, completeness, and comparability, which are described in detail below, and are summarized in the DQO summary table (Table 3-1).

#### **3.6.2.1 Precision**

Precision is defined as a measure of variability or reproducibility of replicate measurements, and is inversely related to the variability among the results obtained (e.g., highly variable results have low precision). Precision is assessed by field and laboratory duplicate result comparisons (including matrix spike duplicates). Field duplicates measure combined field and laboratory precision, whereas laboratory duplicates measure only laboratory precision.

Triplicate samples will be collected as part of the ISM protocol at 50% of the SUs sampled (5 of the 10 surface soil SUs, and 5 of the 10 subsurface soil SUs). The ISM triplicates measure the overall combined variability (precision) due to field heterogeneity and sampling techniques, and will be used primarily to evaluate Site soil variability, and in calculating

statistics such as the 95% UCL on the mean as described in the ISM Guidance and in Section 3.5. Therefore, these ISM triplicates are not splits of the same sample, and are in fact three different samples collected at different starting points within the same SU used to measure soil heterogeneity, and cannot be used in the precision determinations described in this section. Relative Standard Deviation (RSD) will be calculated from the triplicates and compared to a target RSD goal of 35%. Values higher than 35% suggest a higher level of soil heterogeneity within the SU. Implications of soil heterogeneity will be evaluated in the forthcoming risk assessment and feasibility study.

Instead, two separate duplicates will be collected, one to test field precision and another to test laboratory precision. The field precision duplicate will be sampled by collecting two sample cores, side by side, for each of the 30 composite samples, generating two relatively identical samples for one particular SU. The laboratory precision duplicate will be homogenized and split in the laboratory.

Field and laboratory precision will be expressed in terms of relative percent difference (RPD) between the values resulting from duplicate analysis. RPD is calculated as follows:

$$RPD = [(x1 - x2)/X][100]$$

where:

x1 = analyte concentration in the primary sample;  
x2 = analyte concentration in the duplicate sample; and  
X = average analyte concentration in the primary and duplicate sample.

The precision objective for soil sample duplicates will be agreement of sample results to within an RPD of  $\leq 35\%$  when both sample concentrations (original and duplicate) are greater than five times the reporting limit, and plus or minus two times the reporting limit when either of the sample concentrations is less than five times the reporting limit.

### **3.6.2.2 Accuracy**

Accuracy is a measure of the closeness of a reported concentration to a true (i.e., known to a certain degree of confidence) value. For this project, accuracy will be assessed by calculating percent recovery (%R) for laboratory control samples (LCSs), matrix spikes (MS), and matrix spike duplicates (MSD). Matrix spike %R indicates accuracy relevant to a unique sample matrix, while LCS %R indicates accuracy relevant to an analytical batch lot, and is strictly a measure of analytical accuracy conditions independent of samples and matrices. The %R of an analyte, and the resulting degree of accuracy expected for the analysis of QC spiked samples, are dependent upon the sample matrix, method of analysis,

and the compound or element being measured. The concentration of the analyte relative to the detection limit of the method also is a major factor affecting the accuracy of the measurement.

Accuracy is expressed as %R, calculated as follows for matrix spike (and matrix spike duplicate) samples:

$$\%R \text{ for matrix spike samples} = [(A-B)/C] \times 100$$

where:

A = spiked sample concentration;  
B = measured sample concentration (without spike); and  
C = concentration of spike added.

The accuracy objective for matrix spike samples is recovery within the range of 75% to 125%, for samples where the spike value is at least four times the concentration in the original sample.

For LCSs, %R is calculated as follows:

$$\%R \text{ for LCSs} = [(SR/KV)] \times 100$$

where:

SR = reported sample result for LCS; and  
KV = known value of LCS.

Method specific control limits are listed in Table 3-2, for the analysis summarized in Table 5-2, and will be used to compare results and evaluate recovery.

**TABLE 3-2. METHOD SPECIFIC CONTROL LIMITS (PERCENT)**

	LCS/LCSD			MS/MSD			DUP
Parameter <sup>(1)</sup>	Lower	Upper	RPD	Lower	Upper	RPD	RPD
Molybdenum (Mo)	80	120	20	75	125	2	20
Vanadium (V)	80	120	20	75	125	2	20
Manganese (Mn)	80	120	20	75	125	2	20
Arsenic (As)	80	120	20	75	125	2	20
EPH C9-C18 Aliphatics	40	140	50	40	140	50	50
EPH C19-C36 Aliphatics	40	140	50	40	140	50	50
EPH C11-C22 Aromatics	40	140	50	40	140	50	50
1-methylnaphthalene	41	125	20	33	125	30	30
2-methylnaphthalene	40	125	20	30	125	30	30
Acenaphthene	52	125	20	30	125	30	30
Acenaphthylene	50	125	20	30	133	30	30
Anthracene	65	125	20	30	150	30	30
Benzo(a)anthracene	60	125	20	30	150	30	30
Benzo(a)pyrene	69	125	20	30	150	30	30
Benzo(b)fluoranthene	61	125	20	30	150	30	30
Benzo(e)pyrene	71	125	20	30	150	30	30
Benzo(g,h,i)perylene	60	125	20	30	150	30	30
Benzo(k)fluoranthene	67	125	20	30	150	30	30
Chrysene	67	125	20	30	150	30	30
Dibenz(a,h)anthracene	63	125	20	30	131	30	30

	LCS/LCSD			MS/MSD			DUP
Fluoranthene	75	125	20	30	150	30	30
Fluorene	54	125	20	30	147	30	30
Indeno(1,2,3-cd)pyrene	63	125	20	30	150	30	30
Naphthalene	49	125	20	30	131	30	30
Phenanthrene	65	125	20	30	150	30	30
Pyrene	64	125	20	30	150	30	30
TBP	30	150	50	30	150	50	---

### **3.6.2.3 Completeness**

Completeness is defined as the number of samples or valid measurements obtained, compared with the total number planned, expressed as a percentage (“percent complete” or PC). PC is calculated as follows:

$$PC = NA/NI \times 100$$

where:

NA = actual number of samples/valid measurements obtained; and  
NI = intended or planned number of samples/valid measurements.

For this project, two separate measures of completeness will be calculated, as follows:

1. Sampling Completeness – 44 separate ISs are planned for collection under this SAP (including ISM field triplicates). Field QC sampling frequencies are specified in Section 5.4. Sampling completeness will therefore be calculated as the actual number of samples collected (including both routine and QC samples) as a percentage of the planned number of samples included in this SAP. If bedrock expresses in the surface of an SU to an area greater than 75 percent of the total SU area, then that SU will not be sampled and the total number of samples will be modified before calculating sample completeness. Therefore, presence of bedrock will not adversely impact sampling completeness.
2. Data Completeness – Each IS will be analyzed for concentrations of COCs. Data completeness will be calculated as the actual number of valid (not rejected) individual measurements (parameter concentration values) obtained as a percentage of the planned number of total measurements. Results qualified during the data validation process (see Section 4.6.1) are counted as valid measurements, unless the value is rejected during the data verification/validation process.

The completeness goal for this project is 100 percent for sampling completeness, and 95 percent for data completeness. Sampling completeness will be assessed following field sampling activities, and data completeness will be assessed following data validation. If necessary, additional samples may be collected to ensure that project completeness goals are met.

### **3.6.2.4 Comparability**

Comparability expresses the confidence with which data from one sample, sampling round, Site, laboratory, or project can be compared to those from another. Comparability during sampling is dependent upon sampling program design and time periods. Comparability

during analysis is dependent upon analytical methods, detection limits, laboratories, units of measure, and sample preparation procedures.

Comparability is determined on a qualitative rather than quantitative basis. For this project, comparability of all data collected will be ensured by adherence to standard sample collection procedures, standard field measurement procedures, standard reporting methods, including consistent units, and the use of the same analytical laboratory. In addition, to support the comparability of the 10-Acre Pond TCRA confirmation sampling dataset with those obtained in previous investigations, all samples will be analyzed using EPA-approved methods; however, it should be noted that use of the requested ISM sampling protocols during this sampling event (as opposed to other protocols used during previous sampling) will inherently reduce the comparability of data collected under this SAP with previously collected data. All analytical standards will be traceable to standard reference materials. Instrument calibrations will be performed in accordance with EPA method specifications, and will be checked at the frequency specified for the methods. The results of these analyses can then be compared with analyses by other laboratories and/or with analyses for other sites.

#### **3.6.2.5 Representativeness**

Representativeness expresses the extent to which collected data define actual environmental conditions. Similar to comparability, representativeness is determined on a qualitative rather than a quantitative basis. Sample collection, handling, and analytical procedures for the 10-Acre Pond TCRA confirmation sampling have been designed to maximize the representativeness of both sample collection and analytical results, within the fiscallogistical, and practical constraints typically encountered during environmental investigations.

Collection of representative confirmation samples will be achieved by:

- Establishment of appropriate general sampling locations (Section 3.4);
- Collection of 30-point composite samples using methods compatible with the ISM (Sections 4.1 and 5.3); and
- Providing flexibility in designating specific sampling locations, to allow field crews and project managers (PMs) to adjust sampling locations if necessary to achieve a representative sample.

Generation of representative analytical data will be achieved by:

- Use of consistent sample preparation (i.e., homogenization and digestion), analytical, and reporting procedures by Pace Analytical Laboratory; and
- Analysis of specified laboratory QC samples to ensure analytical processes are in control.

Calculation of representative summary statistics (such as 95% UCLs or other statistics) for COCs will be achieved by:

- Validation of data to ensure data quality is sufficient for the intended use;
- Data evaluation to identify outliers and/or other non-representative analytical results; and
- Statistical characterization of datasets to determine the most appropriate statistical methods.

### **3.7 STEP 7: DEVELOP THE PLAN FOR OBTAINING DATA**

Surface and subsurface samples will be collected from the designated SU in the 10-Acre Pond DU using ISM procedures (ITRC, 2012). Samples will consist of composite samples (30 increments) collected in each of 20 SUs (10 surface and 10 subsurface SUs), along with field triplicates in 10 SUs (five surface and five subsurface SUs; see Figure 2-2). The exact number of SUs may be modified based on expression of bedrock in the 10-Acre Pond TCRA footprint, as some SUs may not have enough surface soil to sample. All IS subsamples will be collected using a systematic random grid approach. See Sections 4.1 and 5.3 for details on IS collection.



## **4.0 SAMPLING RATIONALE**

Composite soil samples will be collected using ISM methodology from each of the SUs within the 10-Acre Pond DU. During Site preparation, described above, the field crew will conduct a visual survey of the SUs to determine the extent of bedrock surface expressions. At any SU with surface area consisting of 75 percent or greater bedrock, the remaining soil in that SU will be integrated into the nearest adjacent SU, at the discretion of the Field Team Leader (FTL). In SUs where bedrock expresses at the surface exists but is less than 75 percent of the SU area, the sample gridding will be modified to fit the smaller area, adjusting sample spacing accordingly to reach 30 samples evenly spaced throughout the area. The samples will be analyzed for arsenic, manganese, molybdenum, vanadium, EPH carbon fractions, and TBP.

### **4.1 INTEGRATED SAMPLING**

An IS will be collected at each SU based on the recommendations in the ISM guidance (ITRC, 2012). Twenty one-acre SUs (ten surface and ten subsurface SUs) have been designated for IS to provide samples of the target populations of soil presented above. The SU size was selected to provide information on potential soil “hot spots” coinciding with areas where the pond liner has been compromised, as well as on the concentrations of COCs across the 10-Acre Pond area as a whole. Incremental samples will be collected using a 30-point IS method approach, ten SUs of which (five surface and five subsurface) will be sampled in triplicate to determine overall field and analytical variability, and aid in calculating summary statistics such as a 95% UCL on the mean, as necessary. The SU locations for these samples consist of a 2 by 5 grid within the 10-Acre Pond DU (Figure 2-2).

Within each SU, 30 increments will be collected using the “systematic random grid” approach (ITRC, 2012). This approach is designed to collect essentially random samples from within the DU while also providing that the samples are generally representative of the areal extent of each SU. Each 1-acre SU is broken up into a 3 by 10 grid (30 total samples for each SU without triplicates, 90 total samples for each SU with triplicates), and a sample location selected randomly in one SU cell and systematically repeated through the entire SU. For non-contiguous SUs, for example if a SU has bedrock surface expressions less than 75 percent of the total area, a modified systematic random grid type layout will be developed, appropriate for the size, shape, and total area of the SU. Each incremental subsample location will be marked with labeled survey flagging or pin flags (corners and an approximate center for SUs with a rectangular shape and sufficient boundary points and the approximate center for more unusually shaped SUs when bedrock surface expressions are encountered) to facilitate surveying and to plot the SUs as sampled accurately on figures.

Mapping- or survey-grade global positioning system (GPS) instruments will be the primary method of identifying and marking sampling locations. If sample locations require modification due to presence of bedrock, adjusted locations will be documented using GPS. Bedrock surface expressions will be documented by walking the bedrock perimeter while logging GPS points so that the bedrock areas can be added to Figure 2-2. The GPS measurement collected in the approximate center of the SUs will provide a single GPS point location for the SU database tracking.

The detailed sampling procedure is presented in Section 5.3.

## **5.0 METHOD AND PROCEDURES**

This section describes the procedures to be used to implement the 10-Acre Pond TCRA confirmation sampling, from field sampling and documentation, through laboratory analysis, data validation, and statistical evaluation of the dataset. Standard Operating Procedures (SOPs) relevant to this project are collected in Attachment B. It should be emphasized that SOPs are written to be general guidelines, and that the detailed procedures specified in this SAP supersede those specified in the SOPs. Sample documentation forms to be used during field sampling are in Attachment C.

### **5.1 FIELD EQUIPMENT**

Field sampling crews will take the following equipment (at a minimum) to the field:

- GPS Instrument (mapping- or survey-grade accuracy);
- 300-foot Field Measuring Tape;
- Pin Flags/Survey Tape;
- Soil coring device (manual and/or powered);
- Hammer drill;
- Shovel;
- Project Field Book;
- Field Forms Printed on Waterproof Paper;
- Indelible Ink Pens;
- Digital Camera;
- Disposable Plastic Trowels;
- 2-gallon resealable (Ziploc-type) plastic bags;
- Sample Coolers;
- Ice;
- 5-Gallon Buckets;
- Plastic Trash Bags;
- Paper Towels;
- Scrub Brush;
- Spray Bottles;
- Tap Water;
- Deionized/Distilled Water;
- Alconox or Equivalent non-Phosphate Detergent; and
- Nitrile Gloves.

## **5.2 CALIBRATION AND FIELD EQUIPMENT**

This investigation will not use field equipment requiring calibration. Normal maintenance for hand tools, cameras, or GPS units will be performed as necessary by the field team.

## **5.3 SURFACE SOIL SAMPLING**

### **5.3.1 Field Planning**

Before initiating the sampling event, the following preparatory activities must be completed:

- Schedule all sample analyses, sampling containers and preservatives, and sample delivery through Pace Analytical Laboratories.
- Obtain all necessary field equipment and supplies.
- Identify personnel to perform field sampling.
- Field team will review and discuss elements of the approved SAP and Health and Safety Plan (HASP). Personal protective equipment (PPE) and health and safety guidelines are specified for each activity in the HASP (Attachment D).

### **5.3.2 Field Planning Meetings**

Prior to the field mobilization, each field team member will review all project plans and participate in a field planning meeting. The meeting will be conducted by the PM and attended by all field staff and QA staff. All new field personnel will receive a comparable briefing if they do not attend the initial field planning meeting and/or the tailgate kick-off meeting. The meeting objective is to allow team members to become familiar with the history of the Site, special project requirements, and other items listed below. A field planning meeting may be held in the field instead of the office if this is more convenient for the personnel involved. Supplemental meetings may be conducted as required by any changes in Site conditions or to review field operational procedures.

The meeting will briefly discuss and clarify:

- Objectives of the fieldwork;
- Equipment and training needs;
- Health and safety requirements;
- Field operating procedures, schedules of events, communications, and individual assignments;
- Required QC measures; and
- Documents governing fieldwork that must be on Site.

A written agenda, reviewed by the PM, will be distributed and an attendance list signed. Copies of these documents will be maintained in the project files by the PM. Additional

meetings will be held when the documents governing fieldwork require it, when the scope of the assignment changes significantly, when the field personnel or Site conditions change, or if the PM determines that maintenance of QC protocol requirements merit another meeting.

### **5.3.3 Mobilization / Demobilization**

Mobilization will consist of property access scheduling, field personnel orientation, equipment and field supply ordering, staging, and transport to the Site. Equipment and field supply mobilization will include ordering, renting, and purchasing all equipment and supplies needed for the field activities. This will also include staging and transferring all equipment and supplies to and from the Site.

At the completion of the field activities, equipment and field supplies associated with the specific field activity will be demobilized as necessary from the Site. The FTL and/or designated field staff will be responsible for conducting an inventory of Site equipment and for ensuring that the equipment has been properly cleaned prior to removal off-Site and for securing any equipment to be left on Site. A final Site walkover will be performed to confirm the condition of the Site.

### **5.3.4 Investigation-Derived Waste**

Investigation-Derived Waste (IDW) may be generated during the project, consisting of excess soil sample material and decontamination water. Any excess soil from sample collection will be disposed of in the on-Site repository constructed as part of the 10-Acre Pond TCRA. All liquid wastes will be containerized and eventually shipped off with other liquid wastes from the TCRA.

### **5.3.5 Site Preparation**

Field staff will use GPS equipment to stake out the perimeter of each SU in the 10-Acre Pond TCRA footprint (Figure 2-2). The field team will then lay out the sample grid following the systematic random approach outlined in the ISM (Figure 2-2). If bedrock is present in the SU (up to 75 percent), the systematic random grid sampling scheme will be adjusted accordingly, to collect 30 samples evenly within the remaining soil area at the discretion of the FTL in consultation with the PM. If an SU is more than 75 percent bedrock, then any remaining soil within the SU will be included in adjacent SUs at the discretion of the FTL in consultation with the PM.

### **5.3.6 IS Sampling**

Sampling locations have been determined as discussed in Section 4.0. Exact sampling locations for each increment will be marked using a survey grade GPS, and properly documented as described below and in HSOP-2. In some instances, sampling locations may

need to be modified based on unknown underground structures or other considerations. Any significant changes in sample locations will be considered a variance and will need to be reviewed by the project team (including EPA/IDEQ) prior to sampling (HF-SOP-30).

Each increment will be collected from a depth of 0 to 6 inches for surface samples and from a depth of 6 to 12 inches for subsurface samples. An equal mass of approximately 100 grams of soil (volume of approximately 60 cubic centimeters) will be collected from each of the 30 subsample locations (the approximate volume collected by the coring device described below). The general procedure for collection of samples within a single SU is as follows:

1. Proceed to the flagged increment sampling location and prepare field documentation.
2. Remove large debris (i.e., stones) from the sample point location if necessary.
3. Collect surface (0-6 inches) increment using a stainless steel incremental sampling tool such as a step probe or soil coring device driven by a hammer drill. Note that alternative sampling tools may be used and documented as soil conditions warrant. If alternative tools are used, the mass of soil collected per subsample will remain consistent with the approximate mass/volume collected using the coring tool (100 grams or 60 cubic centimeters).
4. Eject the sample into a gallon HDPE jar labeled with the appropriate surface soil sample number for the SU being sampled. Record description of soil characteristics.
5. Dig a small 0-6-inch pit in the location where the 0-6-inch increment was just collected, of sufficient dimension to allow placement of a probe or coring tool within the pit.
6. Collect the subsurface (6-12 inches) increment using a separate probe, soil coring device, or alternative sampling tool (not the same tool used for surface soil sampling).
7. Eject the sample into a 2-gallon, heavy-duty, HDPE jar labeled with the appropriate subsurface soil sample number for the SU being sampled. Record description of soil characteristics.
8. Backfill sample location.
9. Verify that all field documentation has been recorded.
10. Proceed to next flagged increment sampling location and repeat procedure until all 30 subsamples have been collected.
11. If triplicate field samples are being collected in the current SU, move to the next random starting location, and repeat procedure until three separate ISM samples have been collected in the SU.
12. Note that reused sampling equipment does not require decontamination between each increment, only between each SU or each triplicate sample. As described above, however, separate sampling tools should be used for surface and subsurface sampling.

13. After all 30 subsamples have been collected into the HDPE jar, the sample will be double bagged and placed in an iced cooler to cool sample to at or below 6°C.
14. After completion of an SU, decontaminate sampling equipment as described in Section 5.5 and proceed to next SU.

Equipment/rinsate blanks will be collected twice during the sampling event in between SU composite samples. Equipment/rinsate blanks will be collected after the wash/rinse equipment cleaning cycle, by running laboratory grade DI water over and through the internal chamber of the coring device and/or alternative sampling tool, and then collecting the rinse water in a pre-preserved (nitric acid) plastic bottle for metals analysis only.

### **5.3.7 Sample Numbering**

The SUs delineated for sampling are shown on Figure 2-2, comprising 10 areas with a surface (0-6 inches) and subsurface (6-12 inches) sample to be collected in each area. SUs 1 through 10 are surface soil SUs, and SUs 11 through 20 are subsurface SUs. Surface soil SU 1 corresponds with subsurface soil SU 11, surface soil SU 2 corresponds with subsurface soil SU 12, and so on up to surface soil SU 10 corresponding with subsurface soil SU 20. Individual samples (including QC samples) will be assigned unique sample numbers according to the following sample numbering scheme:

AAAA-YYMM-XXXXX

where AAAA is a four-character code denoting the project (10AP for 10-Acre Pond), YYMM is a four-digit code denoting the year (i.e., 18 for 2018) and month (i.e., 09 for September) of collection, and XXXXX is a three- to five-digit code describing the specific SU sampled (SU1 through SU20) and the field QC identity, if required. Field duplicates will have two unique sample codes and will be blind to the laboratory. Laboratory duplicates will consist of a single sample ID, marked on the COC as a laboratory duplicate, which will be homogenized and split in the laboratory. Field triplicate samples will have A, B, and C appended to the SU descriptor (i.e., if triplicates are collected at SU5 the three samples will be designated SU5A, SU5B, SU5C).

Additional information to be included on the sample container label will include the date and time of collection and any sample preservation information.

### **5.3.8 Field Data QA/QC Procedures**

Field records will be checked for completeness at the end of each day of sampling by the members of the field sampling team. The check of field record completeness will ensure that all requirements for field activities have been fulfilled, complete records exist for each field activity, and that the procedures specified in the SAP were implemented. Field

documentation will ensure sample integrity and provide sufficient technical information to recreate each field event.

#### **5.4 FIELD QUALITY CONTROL SAMPLES**

For this investigation, 30-point composite samples will be collected in triplicate at 10 out of the 20 SUs (50%). The IS triplicates will be collected based on three separate random starting locations within the SU and will thus provide a measure of spatial heterogeneity; therefore, these samples will not be used for laboratory QA/QC purposes, but rather as a measure of Site soil variability as discussed in the ISM Guidance and in Section 3.5. Planned locations for collection of triplicate samples are shown on Figure 2-2; note, however, that some SUs may be entirely covered in bedrock and sampling not possible, and therefore some adjustment of SUs selected for triplicate sampling may be required. Triplicate sample containers will be assigned unique sample identification numbers, as described in Section 5.3.

Two equipment blanks will be collected over the course of the 10-Acre Pond sampling event. Equipment blank samples will be collected from the sample coring apparatus in between SU sample collection, after the equipment has been decontaminated (washed and rinsed).

Two sets of duplicates will be used to evaluate precision, a field duplicate and a laboratory duplicate. The field precision duplicate will be sampled by collecting two sample cores, side by side, for each of the 30 composite samples, generating two relatively identical samples for one particular SU, collected at a frequency of 1 in 10 samples. The laboratory precision duplicate will be homogenized and split in the laboratory from individual samples at the laboratory to be used for QA/QC at a frequency of 1 in 10 samples. Matrix spikes and matrix spike duplicates will be processed in the laboratory as splits from the bulk sample, and will also be analyzed in the laboratory at a frequency of 1 in 10. Separate field samples will not be submitted for duplicates and matrix spike/matrix spike duplicate analysis, as sufficient sample volume will be submitted to the laboratory to prepare the splits. Samples selected for duplicates will not be selected for matrix/spike/matrix spike duplicates. Duplicates and matrix spike/matrix spike duplicates will be randomly selected by field staff. The field duplicates will have their own unique sample ID and will be blind to the laboratory. The laboratory duplicate will be from a single sample designated on the COC as a laboratory duplicate. Samples designated for MS/MSD will be indicated on the COC. Close coordination with the laboratory will be maintained to assure that they properly select samples for QA/QC upon sample arrival. Duplicate results will be used to assess the overall precision of the sampling and analytical methods employed. Matrix spike and matrix spike duplicates will be used to aid in determining precision and accuracy of laboratory procedures.



All field QC sample collection locations and procedures will be fully documented in the field notebook and on field sampling forms. Table 5-1 below summarizes the field quality control for this sampling event.

**TABLE 5-1. FIELD QUALITY CONTROL SUMMARY**

<b>Matrix</b>	<b>Analytical Group</b>	<b>Total # Samples</b>	<b>Field Duplicates/ IS Triplicates</b>	<b>Matrix Spike/Matrix Spike Duplicate</b>	<b>Rinsate Blanks<sup>(3)</sup></b>
Soil	As, Mg, Mo, V, EPH Fractions, TBP	Up to 44 <sup>1</sup>	1 per 10 samples for field duplicates  1 per 10 samples for laboratory duplicates (split in laboratory)  10 of the 20 SUs will be sampled as an IS triplicate <sup>2</sup>	1 per 10 samples for analysis	2 per event

- (1) Samples will not be collected for a particular SU if there is greater than 75 percent bedrock present. Ten of the twenty SUs will be sampled as an IS triplicate, each of which is considered an individual sample.
- (2) Triplicate IS samples will be collected from three different random starting locations within an SU (not split from a single sample). Triplicate samples will be used to evaluate soil heterogeneity.
- (3) For As, Mg, Mo, and V analysis only.

## **5.5 DECONTAMINATION PROCEDURES**

Decontamination procedures will be conducted for any sampling equipment that will be used at multiple SUs (i.e., coring devices, shovels). Decontamination fluids will be containerized on-Site and shipped off-Site with leachate and other liquid IDW generated from the 10-Acre Pond TCRA.

Equipment that is covered with large amounts of adhered soil should be pre-cleaned by brushing or scraping, prior to cleaning with fluids as described below. The following sequential wash, scrubbing, and rinses will be carried out for each piece of equipment to be decontaminated (see HSOP-7, Attachment B):

- Non-phosphate detergent and tap water wash, using a brush if necessary.
- Tap water rinse.
- Deionized/distilled water rinse.

Equipment will either be allowed to air dry or will be dried with clean paper towels at the discretion of the field sampling crew.

## **5.6 SAMPLING DOCUMENTATION AND SHIPPING**

All samples collected and delivered to the laboratory for analysis will follow standard documentation, packing, and chain-of-custody procedures, as described in Attachment B (HSOP-4) and in the following sections.

### **5.6.1 Field Notes and Sampling Log Forms**

General procedures for documentation and labeling of samples, as well as recording information in field notebooks, are in HSOP-29 and HSOP-31 (Attachment B). All field-sampling activities will be recorded in bound, sequentially-paginated field log books and on pre-printed field log sheets (Attachment C). All sample collection entries will include, at a minimum, the following information:

- Project name;
- Date and time;
- Sampling and other personnel present;
- Sample location;
- Sample ID number;
- Sample depth interval;
- Soil descriptions;
- GPS coordinates and datum;
- Weather observations;
- Any deviations from the SAP; and
- Other relevant project-specific Site or sample information.

Entries will be made in permanent ink, with corrections crossed out with a single line, dated and initialed. Field books will be signed at the bottom of each page by personnel making entries on that page. Completed field forms will also be signed by sampling personnel.

### **5.6.2 Photographs**

Photographs will be taken at the sampling locations and at other areas of interest on the Site or sampling area. They will serve to verify information entered in the field logbook. For each photograph taken, the following information will be written in the logbook or recorded in a separate field photography log:

- Time, date, location, and weather conditions;
- Description of the subject photographed; and
- Name of person taking the photograph.

### **5.6.3 GPS Coordinates**

Field teams will use pre-determined GPS coordinates of the sample location. GPS coordinates will also be recorded at the corners and at the approximate center of each SU (see Section 4.1). GPS coordinates will be collected at the perimeter of any areas of exposed bedrock within the 10-Acre Pond. The SOP for collection of GPS data (HSOP-5) is in Attachment B.

### **5.6.4 Sample Labeling, Packaging, and Shipping**

Each sample will be labeled with a unique sample identification number, according to Section 5.3.7. Samples will be stored in iced coolers or refrigerated following collection to maintain a sample temperature of less than or equal to 6°C. Samples will be shipped overnight to Pace Analytical Laboratory, Billings, Montana for analysis, and will be delivered to the laboratory as soon as possible after acquisition, within one or two days after collection.

All sample shipments will be accompanied by the following documentation:

- Chain-of-custody form(s);
- Cover letter to the laboratory describing the accompanying samples; and
- Analytical parameter list with methods and required reporting limits (Table 5-2).

### **5.6.5 Chain-of-Custody**

During and after sampling until the time of delivery, samples will be in the custody of sampling personnel or sample courier. Sample custody (responsibility for the integrity of samples and prevention of tampering) will be the responsibility of the field crews until samples are handed off to a designated courier. “Custody” refers to the samples being in the immediate care of the field personnel, either in physical possession, immediate view, locked up, or held in a secure area restricted to authorized personnel.

Chain-of-custody procedures will be followed to establish a written record of sample handling and movement between the sampling Site and the laboratory. All sample deliveries will be accompanied by a chain-of-custody record, to be signed by both the person delivering the samples and the receiving laboratory. Sampling personnel will retain one copy of the chain-of-custody after signing samples over to the laboratory, and the remaining copies will be transferred to the laboratory. Chain-of-custody forms will be provided by Pace Analytical Laboratory.

Upon arrival at the laboratory, sample custody shifts to laboratory personnel, who are responsible for tracking individual samples through login, analysis, and reporting. At the

time of sample login, the laboratory will assign a unique laboratory sample number, which can be cross-referenced to the field sample number and used to track analytical results.

## **5.7 DATA MANAGEMENT**

In order to provide complete documentation of the 10-Acre Pond TCRA confirmation sampling, detailed field records will be collected by field personnel, as described in Section 5.6. All field notes, sample logs, and Site photographs will become part of the permanent data record, and will be included with the Final Removal Action Completion Report. All hard copy original field documents will be scanned to Adobe Portable Document Format (.pdf) to facilitate electronic storage and transfer. Documentation of sample custody (completed chain-of-custody forms) and sample transfer from sampling personnel to the laboratory, including cover letters and parameter lists with project-required analytical methods and reporting limits, will also be included as part of the field records package for this project.

Laboratory analytical reports and electronic data deliverables (EDDs) will be archived by the project contractor and transmitted to interested parties in electronic and/or hard copy formats. Summary data tables, statistical evaluations and calculations, data validation results and reports, draft and final project reports, and other files generated as part of the data analysis will also be archived by the project contractor.

**TABLE 5-2. ANALYTICAL METHODS, RSLs, AND REQUIRED REPORTING LIMITS FOR IS SAMPLES**

<b>Parameter<sup>(1)</sup></b>	<b>Digestion Method<sup>(2)</sup></b>	<b>Analytical Method<sup>(2)</sup></b>	<b>Required Reporting Limit (mg/kg)<sup>(3)</sup></b>	<b>Method Detection Limit (mg/kg)<sup>(3)</sup></b>	<b>Composite Worker Soil SSL (mg/kg)<sup>(4)</sup></b>	<b>Residential Soil to Groundwater (mg/kg)<sup>(5)</sup></b>	<b>Maximum Holding Time (days)</b>	<b>Preservation</b>
Molybdenum (Mo)	3050B	6020	0.75	0.284	5,800	2	180	Cool to <6°C
Vanadium (V)	3050B	6020	0.75	0.042	5,800	86	180	Cool to <6°C
Manganese (Mn)	3050B	6020	0.25	0.0415	26,000	28	180	Cool to <6°C
Arsenic (As)	3050B	6020	0.5	0.257	3.0	0.0015	180	Cool to <6°C
EPH C9-C18 Aliphatics	DEP EPH 1.1	DEP EPH 1.1	10	1.01	440 <sup>6</sup>	1.5 <sup>6</sup>	7 (extraction) 40 (analysis)	Cool to <6°C
EPH C19-C36 Aliphatics			10	2.68	3,500,000 <sup>7</sup>	2,400 <sup>7</sup>	7 (extraction) 40 (analysis)	Cool to <6°C
EPH C11-C22 Aromatics			10	3.438	600 <sup>8</sup> 33,000 <sup>9</sup>	0.023 <sup>8</sup> 89 <sup>9</sup>	7 (extraction) 40 (analysis)	Cool to <6°C
1-methylnaphthalene <sup>10</sup>	8270/D SIM	8270/D SIM	0.01	0.000638	53,000	0.006	14 (extraction) 40 (analysis)	Cool to <6°C
2-methylnaphthalene <sup>10</sup>			0.01	0.000566	3,000	0.19	14 (extraction) 40 (analysis)	Cool to <6°C
Acenaphthene			0.01	0.000589	45,000	5.5	14 (extraction) 40 (analysis)	Cool to <6°C
Acenaphthylene			0.01	0.000651	---	---	14 (extraction) 40 (analysis)	Cool to <6°C
Anthracene			0.01	0.000527	230,000	58	14 (extraction) 40 (analysis)	Cool to <6°C
Benzo(a)anthracene			0.01	0.00154	---	---	14 (extraction) 40 (analysis)	Cool to <6°C
Benzo(a)pyrene			0.01	0.00105	220	0.029	14 (extraction) 40 (analysis)	Cool to <6°C

Benzo(b)fluoranthene			0.01	0.000556	---	---	14 (extraction) 40 (analysis)	Cool to <6°C
Benzo(e)pyrene			0.01	0.00102	---	---	14 (extraction) 40 (analysis)	Cool to <6°C
Benzo(g,h,i)perylene			0.01	0.000945	---	---	14 (extraction) 40 (analysis)	Cool to <6°C
Benzo(k)fluoranthene			0.01	0.00117	---	---	14 (extraction) 40 (analysis)	Cool to <6°C
Chrysene			0.01	0.000302	---	---	14 (extraction) 40 (analysis)	Cool to <6°C
Dibenz(a,h)anthracene			0.01	0.000459	---	---	14 (extraction) 40 (analysis)	Cool to <6°C
Fluoranthene			0.01	0.000310	30,000	89	14 (extraction) 40 (analysis)	Cool to <6°C
Fluorene			0.01	0.000251	30,000	5.5	14 (extraction) 40 (analysis)	Cool to <6°C
Indeno(1,2,3-cd)pyrene			0.01	0.00104	---	---	14 (extraction) 40 (analysis)	Cool to <6°C
Naphthalene			0.01	0.00102	590	0.00054	14 (extraction) 40 (analysis)	Cool to <6°C
Phenanthrene			0.01	0.00142	NA	NA	14 (extraction) 40 (analysis)	Cool to <6°C
Pyrene			0.01	0.000347	23,000	13	14 (extraction) 40 (analysis)	Cool to <6°C
TBP	8141A	8141A	33.3	11	260	0.025	14	Cool to <6°C

- (1) All parameters will be analyzed on bulk soil sample splits processed at the laboratory, following appropriate ISM sample conditioning (ITRC, 2012).
- (2) Laboratory analytical methods are described in the Laboratory SOPs in Attachment A.
- (3) The laboratory RLs shall be equal to or less than the RSLs. If the RL exceeds the RSL, the Method Detection Limit (MDL) shall be equal to or less than the RSL, if practicable.
- (4) EPA Regional Screening Levels (RSLs) for Composite Worker Soil (EPA, 2017b).
- (5) EPA RSLs for Protection of Groundwater Soil Screening Level (SSL) (EPA, 2017c).
- (6) RSL for medium aliphatics range (C9-C18).
- (7) RSL for high aliphatics range (C19-C32).
- (8) RSL for medium aromatics range (C9-C16).
- (9) RSL for high aromatics range (C17-C32).
- (10) 1 and 2-methylnaphthalene need to be requested separately from the regular suit of PAHs for laboratory analysis.

## 5.8 LABORATORY ANALYSIS

Appropriate laboratory processing is as important as correct implementation of field procedures in providing representative sample concentrations using the ISM technique. General procedures for preparing ISM samples in the laboratory are summarized in Section 6.2 of the ISM guidance (ITRC, 2012) and the SOP for the laboratory (Pace) is in Appendix A. When the sample is received at the laboratory it will be homogenized, split, and sieved to <2 millimeters as a bulk wet sample prior to conducting separate preparations for different analytical techniques (metals, EPH fractions, PAH targets, TPB, and % moisture). After the sample is split in the laboratory, the sample should be homogenized and subsequently subsampled with the same number of increments as were composited in the field (30 subsamples, in this case). The sample splits intended for analysis of organics (EPH, PAH, and TBP), will undergo their respective extractions and analysis as wet weight and then dry moisture corrected. To collect the subsamples for metals analysis, the sample will be air-dried and some form of disaggregation and/or particle size reduction to  $\leq 200 \mu\text{m}$ . A variety of techniques may be used for subsampling, but the final subsample mass must be used completely in the analytical sample preparation step. Section 6.2.2.7 of the ISM guidance (ITRC, 2012) describes the options for subsampling methods. Following homogenization and size reduction, a 1 gram aliquot of soil will be digested for metals analysis. Samples will be processed in accordance with Pace Analytical SOPs including Multi-Increment Soil Sampling (S-MT-I-033-Rev.02), Standard Soil Sieve (S-MT-ME-041-Rev.02) Preparation of Soil Samples for Analysis by ICP and ICP-MS (EPA 3050B) and Metals Analysis by ICP-MS (EPA 6020) for metals, Determination of EPH (DEP EPH 1.1), Extractable Base/Neutral and acid Organic Compounds (PAHs) in Solid and Liquid Matrices by GC/MS (EPA 8270C/D, 625 SIM), and extraction and analysis of TBP (EPA 8141A), modified as appropriate to comply with ISM guidance. Each laboratory SOP is provided in Attachment A.

Quality control samples (duplicates, matrix spike, matrix spike duplicates) will be randomly assigned by field staff. Field duplicates will have their own unique sample ID and will be blind to the lab. Laboratory duplicates will be split from samples designated on the COC. Samples selected for MS/MSDs will also be indicated on the COC. Samples selected for use as a duplicate sample will not also be selected for use as a matrix spike/matrix spike duplicate, and vice versa.

All laboratory analysis will be conducted in accordance with the Pace Analytical Laboratories approved laboratory quality assurance plan (Attachment A). Laboratory analysis will consist of determination of total metals concentrations, EPH carbon fractions, PAH target compounds, and TBP, using appropriate digestion and analytical procedures as outlined in Table 5-2. Note that 1 and 2-methylnaphthalene will need to be requested separately from the regular suit of PAHs for laboratory analysis. The laboratory will produce

a Level 4 data package. Standard laboratory turnaround time (25 days for Level 4 reports) will be requested. Required project reporting limits and analytical methods for individual constituents are also presented in Table 5-2. The laboratory RLs shall be equal to or less than the RSLs. If the RL exceeds the RSL, the Method Detection Limit (MDL) shall be equal to or less than the RSL, if practicable.

## **5.9 DOCUMENTATION AND RECORDS**

All data generated from field activities such as field notebooks and sampling forms will remain in the possession of field sampling crews during the field sampling event. Upon return from the field, field sampling crews will duplicate and scan all hard copies of their records as soon as possible, to prevent the possibility of lost or misplaced information. Laboratory transmittal documents (chains-of-custody, cover letters, and analytical parameter lists) will also be duplicated and scanned after samples are delivered to the laboratory. Electronic and hard copies of these records will be stored in the project contractor's files and network system, and provided to EPA as part of the final project report.



## **6.0 DATA EVALUATION**

Data evaluation for the 10-Acre Pond TCRA confirmation sampling will consist of two components: (1) data verification and validation to assess data quality, and (2) statistical analysis of the validated dataset to determine the data distribution, summary statistics, and any other statistics (e.g., 95% UCL on the mean) necessary to fully characterize post-removal COC concentrations in soils. All data verification, validation, and statistical analysis will be conducted using standard office-type personal computers, configured with software appropriate for the proposed activities, including (at a minimum) Microsoft® Word and Excel, and the latest version of EPA's ProUCL software (Version 5.0 or later).

### **6.1 DATA VERIFICATION AND VALIDATION**

Overall completeness and adherence to project procedures will be assessed through validation and verification (HSOP-58, Attachment B). Verification includes confirmation of adherence to sample design, collection, handling, custody, transmittal, and documentation procedures. Validation includes the confirmation of adherence to specific analytical procedure criteria and protocols, and the assessment of data quality in terms of usability. Data validation and verification will be conducted by data management staff, with oversight by the PM.

The number and type of samples collected will be compared with project specifications to ensure conformance with the sampling process design. Review of sample collection and handling procedures will include verification of the following:

- Completeness of submittal packages;
- Completeness of field documentation, including chain-of-custody documentation;
- Field equipment calibration and maintenance and/or quality of field measurements; and
- Adherence to proper sample collection procedures.

The laboratory will provide the project contractor with EDDs. Upon receipt of EDDs, laboratory data reports will be reviewed for completeness and administrative errors. Following this procedure, data validation will be conducted by the project contractor in general accordance with the principles of the EPA national functional guidelines for inorganic data review (EPA, 2017d), USEPA National Functional Guidelines for Organic Superfund Methods Data Review (EPA, 2017e), IDEQ's Quality Management Plan (IDEQ, 2016), and as described in Section 6.2.5 of the approved Final Supplemental Remedial Investigation Work Plan (Tetra Tech, 2015). Consistent with the procedures described in Tetra Tech (2015), 10 percent of all data received from the laboratory as part of this investigation will be Level 4 validated and the other 90 percent will be Level 2b validated. The results of this validation will be summarized in the project report.

Level 2b validation includes evaluation and review of:

- When applicable, verification that the mass tuning of the instrument is performed at the proper frequency with required detection limits, along with continuous review of calibrations and method specific compliances;
- Results of laboratory method and field blanks, with associated appropriate qualifiers;
- QC sample %Rs and/or RPDs;
- Field sampling precision as evidenced by RPDs;
- Summary of method deviations; and
- Documentation supporting all qualifications.
- Instrument QC forms and preparation logs.
  - Initial calibration summaries;
  - Initial and continuing calibrations verification summaries;
  - Method specific forms;
  - All above forms for second column or detector; and
  - Preparation logs.

Level 4 validation includes evaluation and review of:

- QC sample percent recoveries (%Rs), percent deviations (%Ds), and/or RPD to check if sample analysis falls within established QC limits;
- Additional QC checks may include: Interference check sample (ICS) %R, internal standard areas and/or %Rs, laboratory duplicate RPDs, and serial dilution %Ds. Results will be qualified accordingly if non-compliance to QC protocol is observed;
- Review of raw data including: sample quantitation reports, chromatographs, and/or mass spectra. Verification of detected results. Sample calculations for each analytical fraction reviewed in the data package and inclusion of the sample calculations in the data validation report; and
- All additional components of the Level 2b validation.

Qualifiers will be added to the data as required, and any data quality issues will be discussed in the validation report. The results of the confirmation sampling will be presented in the Final Removal Action Completion Report and will also include a discussion of any uncertainty or biases associated with the data, as indicated by field or lab QC sample results or other results of the validation. Validation results will be evaluated in terms of any potential effects on the intended data uses (characterization of SU and DU COC concentrations, calculation of summary and/or additional statistics), and the usability of all qualified data will be evaluated based upon how much uncertainty it introduces into the analysis.

Validated data will be incorporated into data summary tables in a format appropriate for both reporting and subsequent statistical analysis. Results included in summary data tables and used in statistical analyses will be verified for accuracy (against original laboratory reports/EDDs) prior to inclusion in the final project report.

### **6.1.1 Identification of Valid Samples**

The identification of valid samples involves interpretation and evaluation of the field records to identify problems affecting the representativeness of environmental samples. Judgments of sample validity will be documented in the validation report, any environmental data associated with poor or incorrect fieldwork will be identified, and the potential impacts on data utility (if any) will be noted in the data validation report.

## **6.2 STATISTICAL ANALYSIS**

Statistical analysis of the validated dataset obtained during the 10-Acre Pond TCRA confirmation sampling will be conducted using EPA's ProUCL software (Version 5.0 or later), supplemented by additional statistical software if necessary. For example, data may be used to calculate a statistically appropriate 95% UCL on the mean. Additional summary statistics and exploratory data analysis (EDA) may be conducted to support other project needs. The current version of ProUCL includes methods for distribution testing, calculating summary statistics, and calculating UCLs, among other methods.

Statistical analysis of soils data using ProUCL will likely include (but not necessarily be limited to):

- Summary statistics;
- Data distribution;
- Tests for outliers; and
- Calculation of UCLs.

The statistical approach for calculation of UCLs will be discussed with EPA/IDeq after the datasets for constituents of interest have been characterized. The intent is to use all valid analytical data (including any nondetect data) in the statistical calculations. ProUCL allows for robust treatment of nondetects (NDs) by extrapolating estimated values for NDs using both regression on order statistics and Kaplan-Meier methods.

### **6.3 LABORATORY QUALITY CONTROL SAMPLES**

Laboratory QC sample types and frequencies (including duplicates, matrix spikes and matrix spike duplicates, and laboratory control standards) will be consistent with the quality assurance plan and SOPs of Pace Analytical Laboratory (Attachment A). The results of laboratory QC sample analysis will be reviewed during the data validation process.

## **7.0 CORRECTIVE ACTION**

Corrective action is the process of acting on non-conforming procedures that deviate from the procedures set forth in this SAP. Corrective actions can be implemented for field activities, laboratory analyses, data validation, and data assessment. The data validation report will document non-conforming conditions identified (e.g., when overall objectives for precision, accuracy, completeness, representativeness, or comparability are not satisfied), or when procedural practices or conditions differ from those described in this SAP. All corrective actions proposed and implemented will also be documented and will include measures to preclude a repetition of the original deficiency. The PM and QA Manager will be notified immediately of all non-conformances with this SAP that affect data quality before initiation of corrective actions both in the field and in the laboratory. Corrective action will only be implemented after review and approval by the PM and QA Manager. Approved corrective actions will be documented in the sampling project report.

### **7.1 FIELD CORRECTIVE ACTION**

Field conditions may vary from those anticipated in project planning documents; therefore, it may become necessary to implement minor modification to sampling procedures presented in this SAP (see HFSOP-30 in Attachment B). If such modifications are deemed necessary, EPA/IDeq will be notified and verbal approval obtained prior to implementing the changes (if feasible), or as soon as possible thereafter. Any field modifications or corrective actions will be documented in the field logbook, and in the data validation and final project reports.

### **7.2 LABORATORY CORRECTIVE ACTION**

The laboratory is required to comply with the most recent version of their Quality Assurance Manual (February 2014), including all applicable SOPs. The Laboratory PM will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this SAP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data. The Laboratory PM or QA/QC Manager will be notified if any quality control sample exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analysis. A narrative describing the anomaly, the steps taken to identify and correct the anomaly and the treatment of the relevant sample batch (i.e., recalculation, reanalysis) will be submitted with the data package in the form of a cover letter.

### **7.3 DATA VALIDATION, VERIFICATION, AND ASSESSMENT CORRECTIVE ACTION**

Corrective action may be needed based on either the data validation/verification or data assessment (statistical evaluation). If corrective action is needed, recommendations will be made to EPA/IDEQ. Potential types of corrective action based on data validation / verification or data assessment may include re-sampling or re-analysis of samples by the laboratory. Recommended corrective actions may alter the project schedule, and will require approval by EPA/IDEQ prior to implementation. All corrective actions will be fully documented in the Final Removal Action Completion Report.

## **8.0 FIELD HEALTH AND SAFETY PROCEDURES**

A Site specific HASP has been prepared to cover all activities associated with the 10-Acre Pond TCRA and confirmation sampling and details Site safety concerns and protocol (Attachment D). PPE required for confirmation sampling includes the following Level D and Modified Level D PPE:

Level D PPE:

- Field clothing (long pants, short or long sleeve shirt);
- Hard hat;
- Steel-toed boots;
- Reflective vests; and
- Hearing protection (when needed).

Modified Level D PPE:

- Disposable Nitrile Gloves;
- Half-face respirator using HEPA filters (must be readily available at the Site for use during any activities that generate airborne dust);
- Tyvek coveralls (when needed); and
- Plastic boot covers (when needed).

Hearing protection, Tyvek coveralls, and plastic boot covers may not be needed during confirmation sampling; however, this equipment should be on Site in case field personnel identify a need for these PPE.

## 9.0 REFERENCES

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- Brewer, R., Nagashima, J., Kelley, M., Haskett, M., Rigby, M. 2013. Risk-Based Evaluation of Total Petroleum Hydrocarbons in Vapor Intrusion Studies. International Journal of Environmental Research and Public Health. 10. 2441-2467.
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- Tetra Tech, 2015. Final Supplemental Remedial Investigation Work Plan. Former Tronox/Kerr-McGee Chemical Corporation Superfund Site, Soda Springs, ID. October 2015.
- Tetra Tech, 2017. Draft Phase I and Phase II Supplemental Remedial Investigation Report. Former Tronox/Kerr-McGee Chemical Corporation Superfund Site, Soda Springs, ID. June 2017.




## **ATTACHMENT A**

### **PACE ANALYTICAL QUALITY CONTROL PLAN AND STANDARD OPERATING PROCEDURES**

**PACE ANALYTICAL QUALITY CONTROL PLAN  
AND STANDARD OPERATING PROCEDURES**

<b>SOP #</b>	<b>TITLE</b>
QA/QC Manual	Quality Assurance Manual: Quality Assurance/Quality Control Policies and Procedures
SM-MT-I-033-Rev.02	Multi-Increment Soil Sampling
S-MT-ME-041-Rev.02	Standard Soil Sieve
S-MN-O-507-Rev.28	Extractable Base/Neutral and Acid Organic Compounds (PAHs, cPAHs, Pentachlorophenol) in Solid Liquid Matrices by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique with Selected Ion Monitoring
S-MT-O-001-Rev. 13	Determination of Extractable Petroleum Hydrocarbons (EPH)
S-MN-I-460-Rev. 19	Preparation of Solids Samples for Analysis by ICP and ICP-MS
S-MN-I-492-Rev. 28	Metals Analysis by ICP/MS
ALS-407	Organophosphorus Compounds by Gas Chromatography
ALS-617	Continuance Liquid/Liquid Extraction (CLE)

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# QUALITY ASSURANCE MANUAL

## Quality Assurance/Quality Control Policies and Procedures

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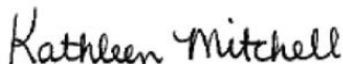
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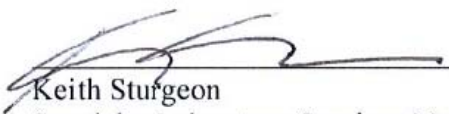
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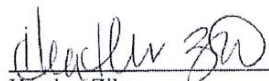
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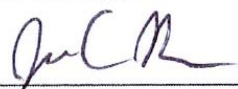
  
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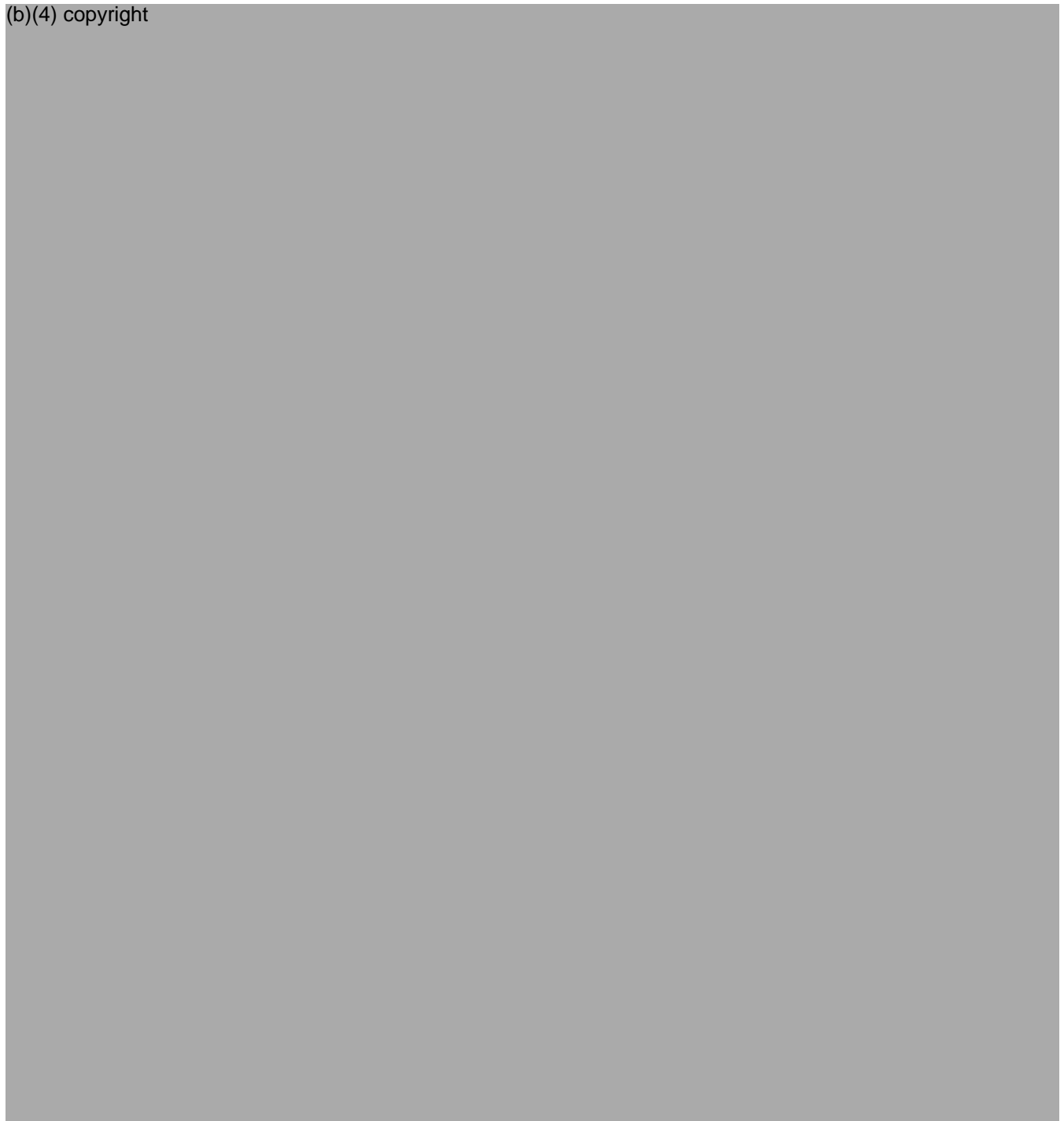
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**STANDARD OPERATING PROCEDURE**  
**MULTI INCREMENT SOIL SAMPLING**  
**METHOD NA**

**Reference Methods: ITRC Incremental Sampling Methodology**  
**State of Alaska Draft Guidance for Multi Increment Soil Sampling**  
**State of Hawaii Multi-Increment Sample Collection**

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## STANDARD OPERATING PROCEDURE

### STANDARD SOIL SIEVE

Reference Methods: NA

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## STANDARD OPERATING PROCEDURE

### Extractable Base/Neutral and Acid Organic Compounds (PAHs, cPAHs Pentachlorophenol) in Solid and Liquid Matrices by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique with Selected Ion Monitoring

Reference Methods: EPA 8270C/D, 625 SIM

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**STANDARD OPERATING PROCEDURE**  
**DETERMINATION OF EXTRACTABLE PETROLEUM HYDROCARBONS**  
**Reference Methods: Modified Massachusetts DEP EPH 1.1**

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**EXAMPLE QUALITY ASSURANCE REVIEW FORM**

I \_\_\_\_\_, as the designated Quality Assurance Officer, hereby attests that all electronic deliverables were thoroughly reviewed and are in agreement with the associated hardcopy data. The enclosed electronic files were reviewed for accuracy (including significant figures), completeness and format. The laboratory will be responsible for any labor time necessary to correct enclosed electronic deliverables that are found to be in error. I can be reached at (\_\_\_\_\_) if there are any questions or problems with the enclosed electronic deliverables.

Signature: \_\_\_\_\_ Title: \_\_\_\_\_ Date: \_\_\_\_\_